GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

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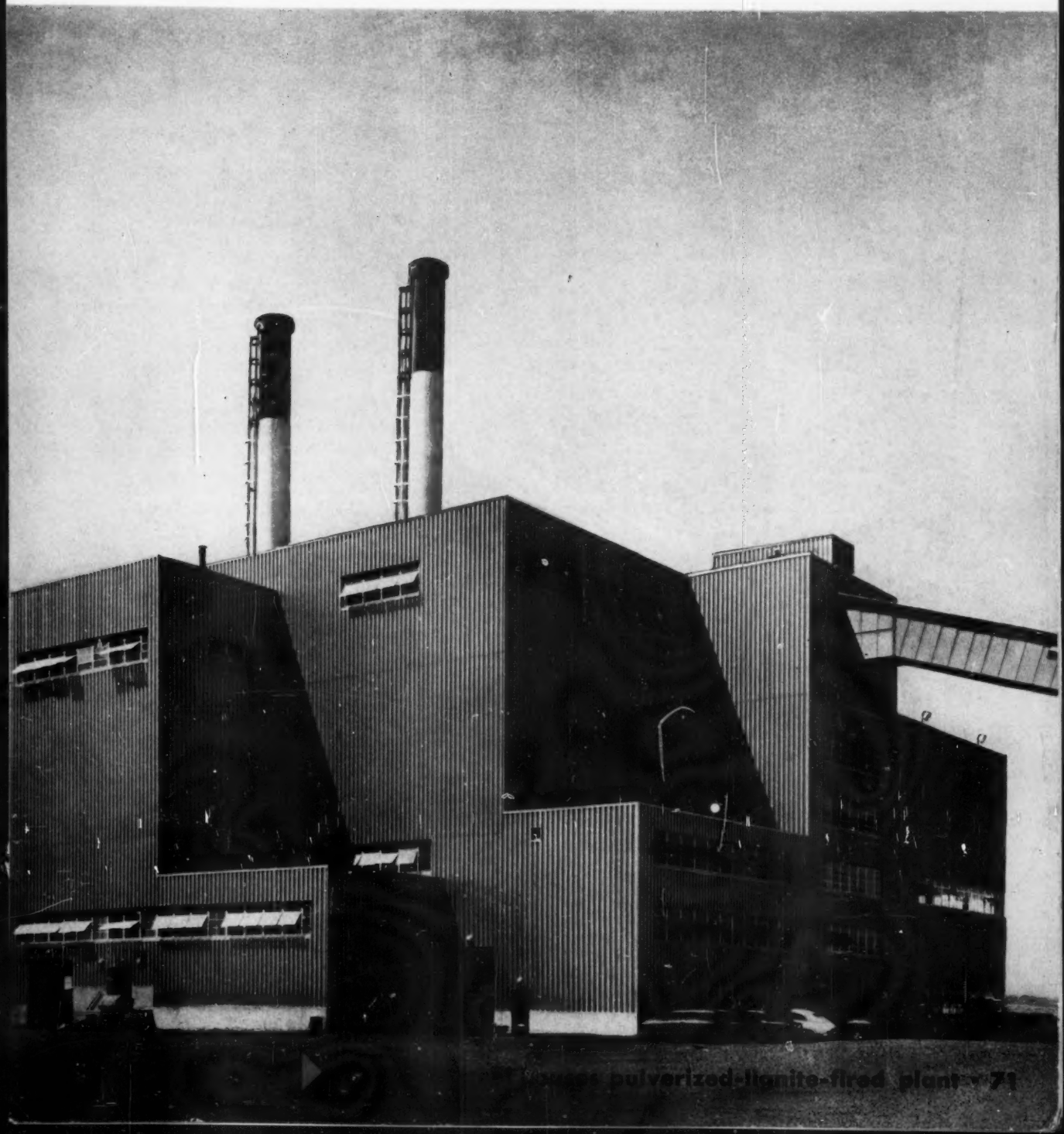
Power

January
1953•50¢

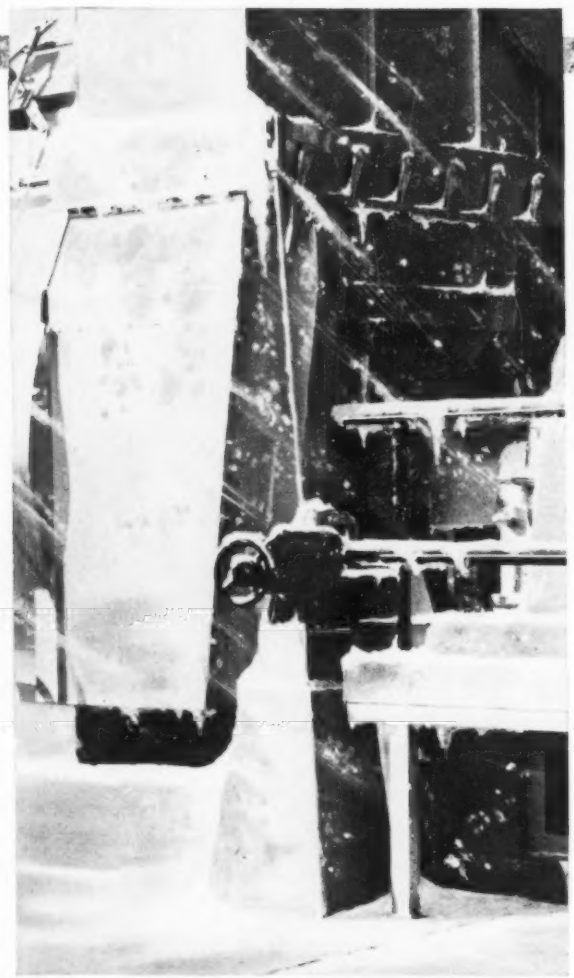
A McGRAW-HILL PUBLICATION

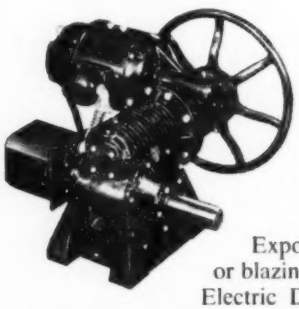


Tacoma's pulverized-lignite-fired plant • 71

L&N ELECTRIC DRIVE UNITS OPERATE

"weather or not"





Exposed to ice, sleet or blazing sun, this L&N Electric Drive Unit provides indoor performance on outdoor applications. Because the drive unit is such a vital link in a combustion control system, the weather-free operation of Electric Drive Units is a real advantage for L&N Metermax Combustion Control on outdoor-type plants.

In addition, the L&N Electric Drive Unit provides many more benefits which make it equally valuable for indoor applications. For example:

Indicates true position—small indicating meters on control board show actual drive unit movement, rather than a loading pressure which *should* produce a movement.

Can't be backdriven—self-locking double worm gear does away with additional locking devices.

Transfers instantly—from automatic to remote manual control; there is no intermediate, reset or balancing position required.

Uses auxiliary power—remote control is as reliable as station auxiliary power. The unit releases itself after a service interruption . . . operator does not have to unlock or reset the various units.

Works manually—geared-down handwheel makes manual operation easy.

Write to Leeds & Northrup Company, 4910 Stenton Avenue, Philadelphia 44, Pa.

CAREER OPPORTUNITIES AT L&N

Expansion program of this long-established firm has many features to attract outstanding recent graduates in engineering and science. Opportunities are in sales field engineering, product and application engineering, research, advertising, market development. Widely-respected policies assure recognition of progress and achievement. Address Personnel Manager for interview at nearest of 17 L&N offices.

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Instruments *Automatic Controls • Furnaces*

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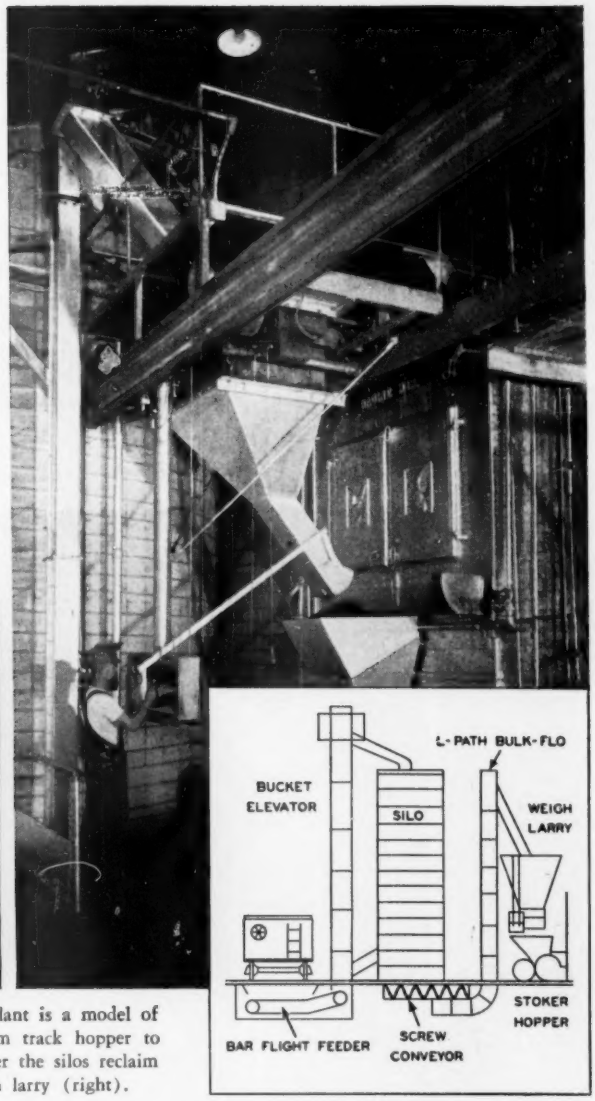


This Link-Belt coal handling system in an industrial power plant is a model of compactness and efficiency. Bar flight feeder moves coal from track hopper to bucket elevator feeding two silos (left). Screw conveyors under the silos reclaim to L-type Bulk-Flo Conveyor-Elevator, which delivers to weigh larry (right).

Sure way to cut power plant costs . . . start with efficient coal handling

No two power plants have exactly the same operating requirements or physical limitations. That's why Link-Belt's broad experience in designing and building coal handling systems offers you unique advantages.

Consider, too, the completeness of the Link-Belt line. Our engineers can choose from all types and sizes of equipment for unloading, storing, handling and weighing your coal. And Link-Belt will assume complete responsibility for the entire installation—from planning to erection, if desired.

New Book 2410 shows latest equipment and system layouts for power plants large and small. Ask your nearest Link-Belt office for a copy. You may find some ideas that will help cut your coal handling costs.

LINK-BELT

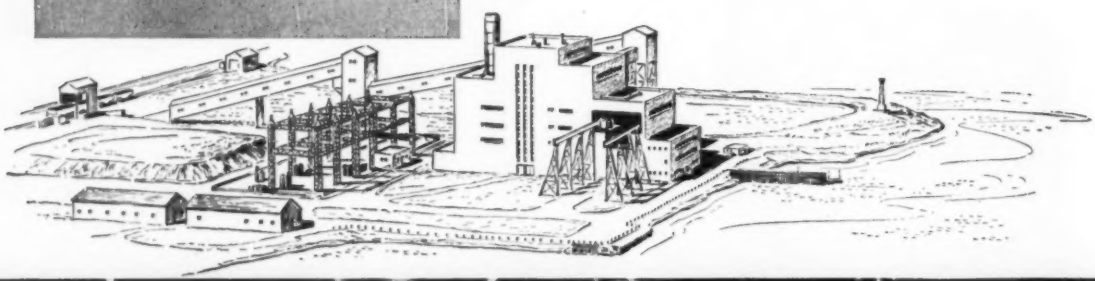
COAL HANDLING EQUIPMENT

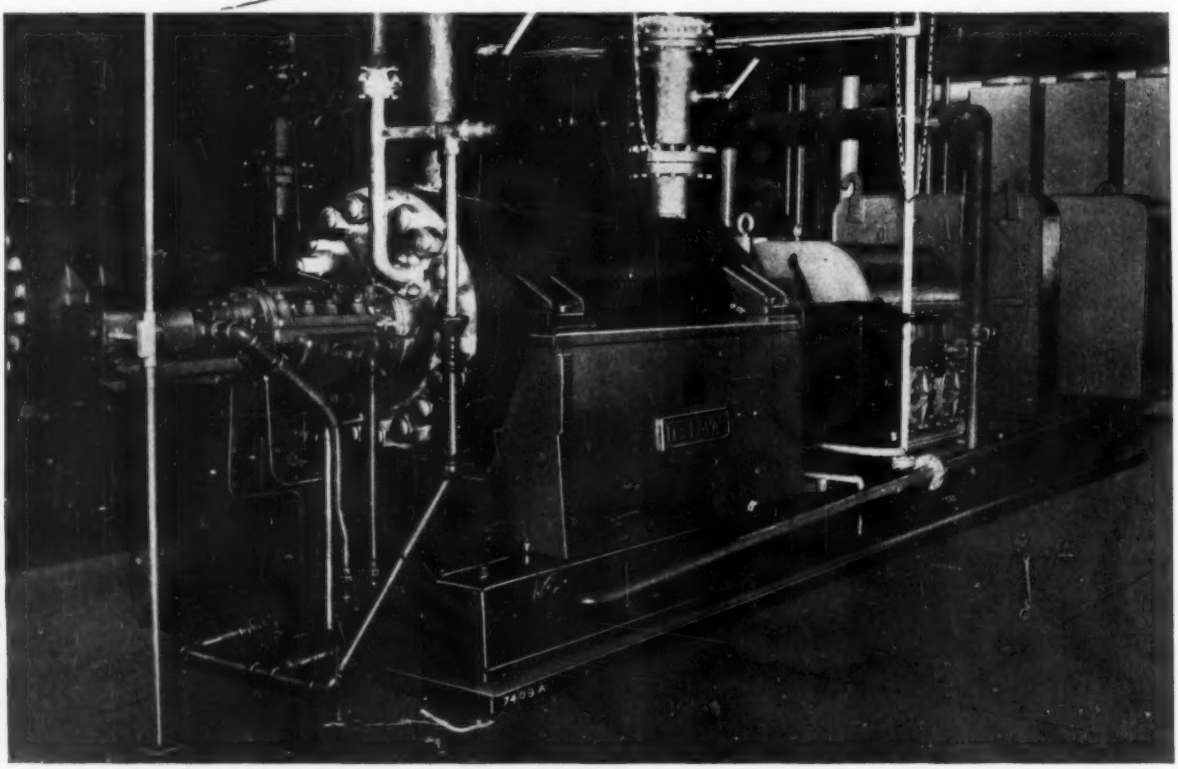
LINK-BELT COMPANY Plants: Chicago, Indianapolis, Philadelphia, Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities. 12.901

DE LAVAL

BARREL TYPE BOILER FEED PUMPS

on the job at Danskammer Point





These two De Laval 11-stage barrel type boiler feed pumps are now helping to produce power for the Danskammer Point Steam Station of the Central Hudson Gas and Electric Corporation. Both pumps, one of which is used for standby service, are sized for full boiler load and will deliver 1,400 gpm of 326F water against 2,155 psig discharge pressure. Two more same size De Laval pumps have already been ordered for the second main unit of the Danskammer Station.

De Laval barrel type boiler feed pumps meet all the requirements of high pressure boiler feed service. They can be thrown on the line quickly without long preliminary warming up. They are not affected by sudden temperature changes. The distinctive De Laval design assures years of reliable service with minimum maintenance.

DE LAVAL *Boiler Feed Pumps*

DE LAVAL STEAM TURBINE COMPANY

815 Nottingham Way, Trenton 2, New Jersey

DL 178

Power

JANUARY 1953 • VOLUME 97 NUMBER 1

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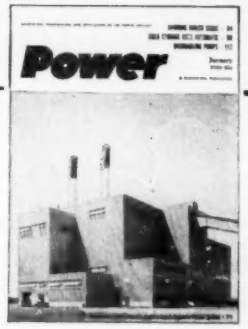


LIGNITE is a major fuel in the northern prairie states but it usually has been fired on grates. Thus special interest attaches to the new William J Neal Station of Central Power Electric Cooperative, where lignite is pulverizer fired. Some 30 miles southeast of Minot, S. D., the plant is practically at mine mouth, receiving fuel by a short haul over a private railroad.

Cover photo shows another feature of the station—use of insulated stainless-steel curtain walls. Severe climate made it seem wise to enclose all equipment except high-tension switchgear. Thus, denied the savings possibilities of outdoor construction, the designers turned to this economical and easy-to-maintain enclosure to keep building costs to a minimum.

Next month . . .

■ Plenty of new ideas have been coming along in greases, fluid and solid lubricants. To get up to date quickly, scan our February lube roundup.

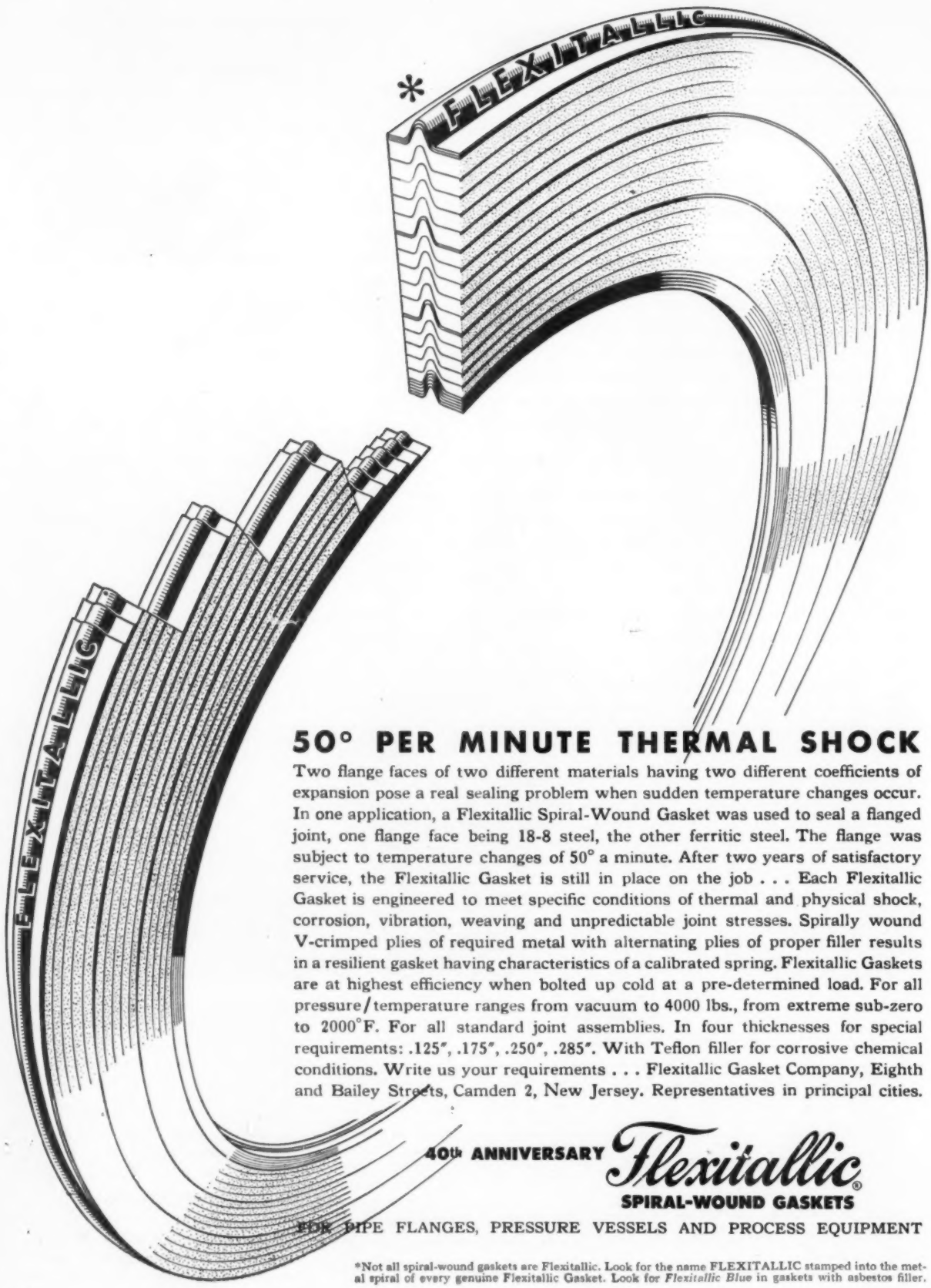
■ With reheat now standard practice for large central stations, we're ready to take a look at what may be the next step—double reheat. Next month Shannon and Selby give you results of a study comparing double reheat with the familiar single-reheat cycle.

■ How well vertical pumps perform depends to a large extent on inlet conditions. Tests on models prove an economical way of spotting inlet layout defects and correcting them.

■ Over at Charles Pfizer & Co, they're bursting with good ideas on electrical maintenance, as Associate Editor Jim O'Connor found out on a recent visit. In February he'll tell you how they design and select equipment to keep maintenance to a minimum, and then how they go about doing the needed work in the best way.

. . . and future months

■ You've liked Sheppard T Powell's articles on basic water-treatment processes, so you'll be glad to know that we have more on the way.



50° PER MINUTE THERMAL SHOCK

Two flange faces of two different materials having two different coefficients of expansion pose a real sealing problem when sudden temperature changes occur. In one application, a Flexitallic Spiral-Wound Gasket was used to seal a flanged joint, one flange face being 18-8 steel, the other ferritic steel. The flange was subject to temperature changes of 50° a minute. After two years of satisfactory service, the Flexitallic Gasket is still in place on the job . . . Each Flexitallic Gasket is engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses. Spirally wound V-crimped plies of required metal with alternating plies of proper filler results in a resilient gasket having characteristics of a calibrated spring. Flexitallic Gaskets are at highest efficiency when bolted up cold at a pre-determined load. For all pressure/temperature ranges from vacuum to 4000 lbs., from extreme sub-zero to 2000°F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285". With Teflon filler for corrosive chemical conditions. Write us your requirements . . . Flexitallic Gasket Company, Eighth and Bailey Streets, Camden 2, New Jersey. Representatives in principal cities.

40th ANNIVERSARY *Flexitallic*®
SPIRAL-WOUND GASKETS
FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

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Power

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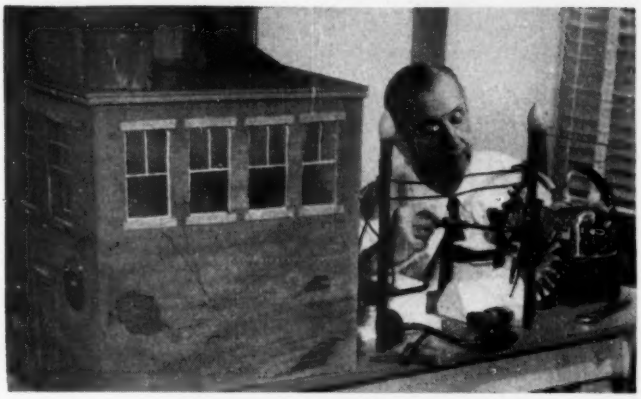


Swain and one-kettle-power industrial plant

POWER-SHOW VISITORS got a bang out of the humorous model on which Editor Phil Swain puts a finishing touch in the photo above. Product of Phil's agile mind and clever hands, its one-kettle-power turbine spun a homemade generator to light the lamps and turn the factory wheels. And when you pushed the button (*left*) out popped a sample of the factory's product—a book of genuine Marmaduke Surfaceblow matches. That took some ingenious gadgetry inside the building and Phil had many hours of fun working out the bugs.

Leslie B Schramm

Andrew G Hult

Alexander S Kuli

COMPRESSOR KNOW-HOW is a tradition of the Schramm family, and Leslie B Schramm is no exception. His high-school and college vacations were spent in the shop learning compressors from the ground up. Graduate of Haverford (BS in engineering), Leslie took up full-time duties with Schramm Inc in 1938, has worked in all departments. He is now sales manager and secretary.

Active in the Compressed Air and Gas Institute, Leslie heads its executive committee, and is also chairman of the stationary compressor section and the committee on engineering education. From this strong background, he puts forward, on p 75, a distinctive approach to plant air systems.

Leslie finds relaxation in his darkroom and home shop, enjoys making and repairing anything mechanical.

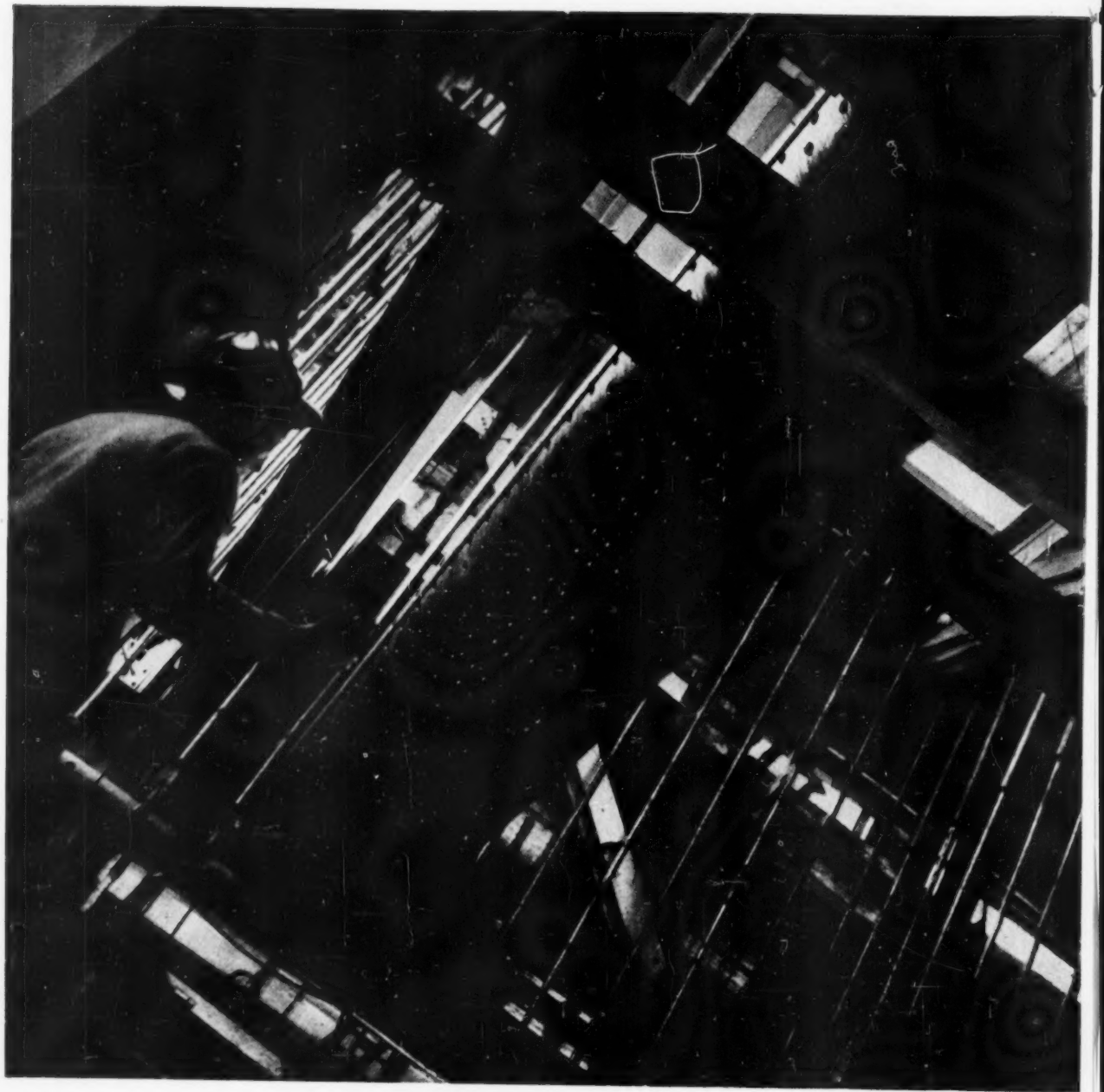
STRUCTURAL PLANNING is a subject on which Andrew Hult speaks with authority, as you can see by turning to pp 80-83. He has been at it, in one way or another, since before his college days at Rensselaer (CE, 1934). In utility companies, contracting firms and engineering offices, he has gained experience in just about every phase of planning, design and construction.

Even during a World War II stint with the Navy, Andrew was able to carry on along similar lines, developing and testing the pontoons used to make barges, bridges, dry docks, causeways. He also saw service in the Pacific with the fast-moving Seabees.

With Burns & Roe since 1941, he has worked on planning of a wide variety of utility and industrial plants, is now engaged on three large projects.

HIGH-TEMPERATURE hot-water heating may cost more at first but quickly proves its economy, argues Alexander Kuli in the article beginning on p 96. This is in line with his personal philosophy that the seemingly least expensive solution of a problem is often the most expensive in the long run.

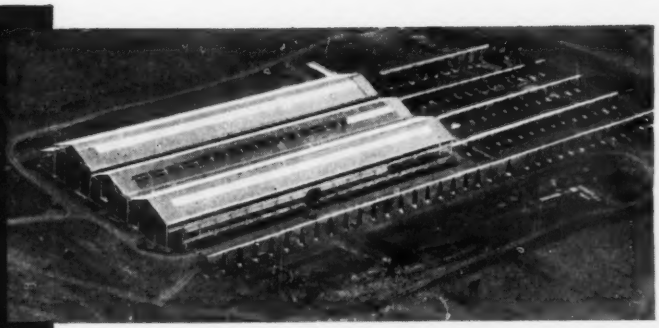
Born in Hungary, Alex is a graduate of the University of Pécs (1937) and also of the Technological Academy of Munich. With a background in heating and air conditioning, he came to the U.S. in 1951 under the Displaced Persons Act. Shortly after starting work with American District Steam Co in No. Tonawanda, N. Y., the rapid expansion of the Adsco plant gave him opportunities to prove there the economic worth of high-temperature hot-water heating for large industrial plants.



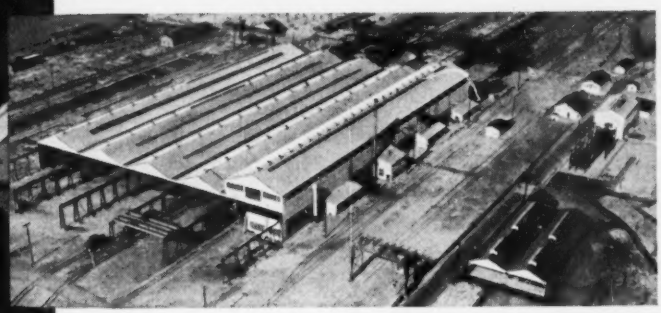
SPEEDING STEAM POWER

BABCOCK & WILCOX

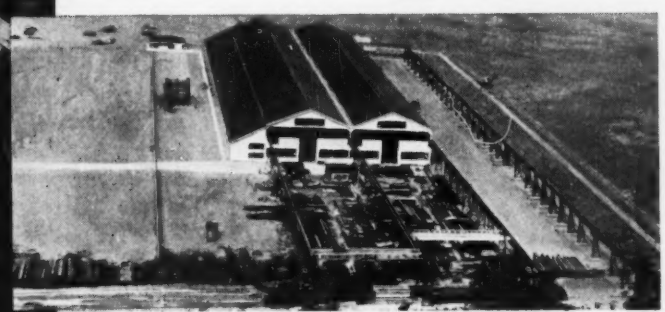
G-582T



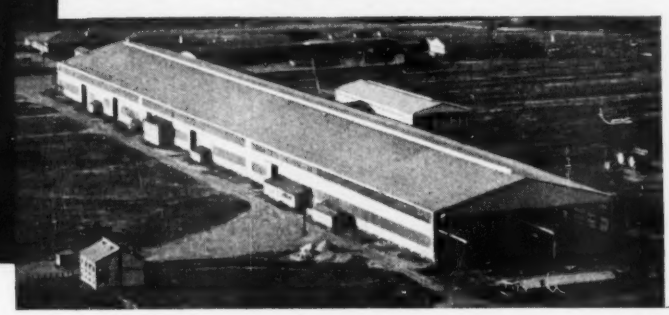
Paris, Texas



Wilmington, North Carolina



West Point, Mississippi

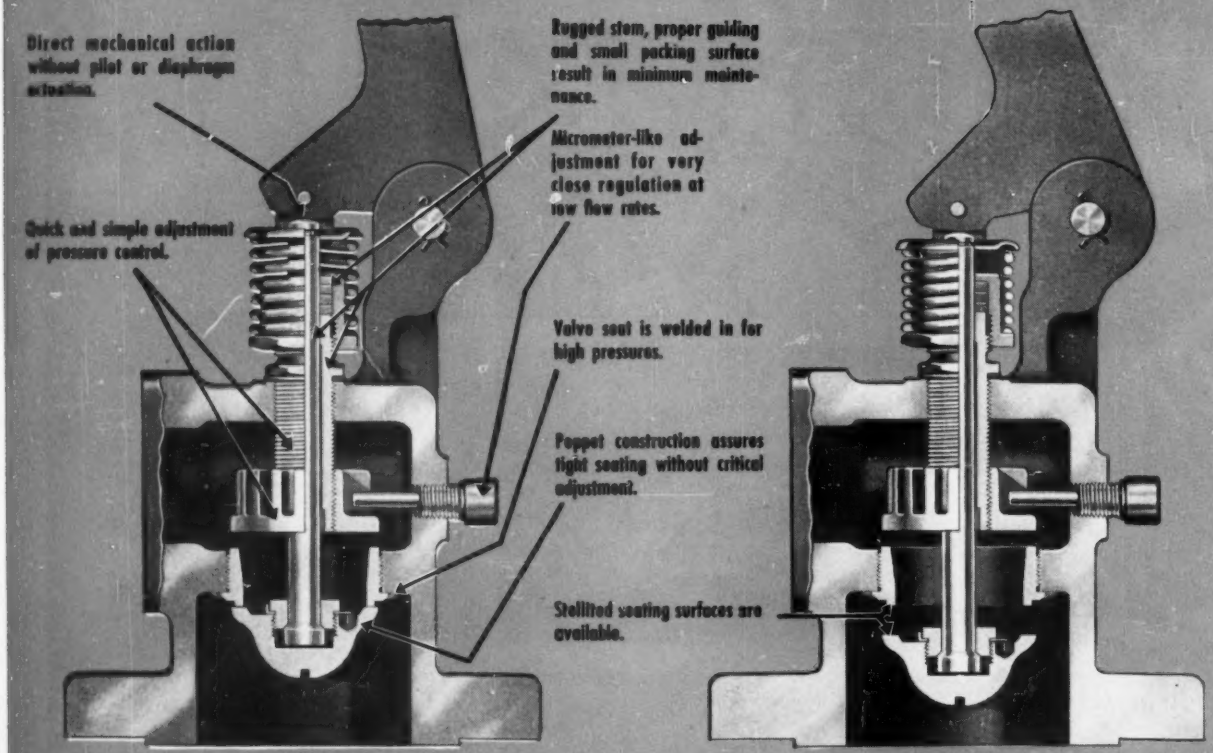


Brunswick, Georgia

ON FOUR NEW FRONTS

America's industrial growth is measured in kilowatts, units of electrical energy which make up the brawn and sinew of U. S. production. More and more of these energy units are being consumed in this land which is, characteristically, always building, always pioneering. In fact, so many lusty, bawling industrial infants—children of America's men of vision—are growing up so fast that Babcock & Wilcox is pouring millions of dollars into new plants and equipment to provide more steam power for public utilities and for all industry. New plants at Wilmington, N. C., West Point, Miss., Brunswick, Ga., and Paris, Texas, recently have been added to B&W's network of facilities for manufacturing the equipment to harness energy through the driving force of steam. In all, ten great B&W plants, spotted around the map like sentinels helping to guard the nation's strength, are efficiently geared to continue to contribute to America's boundless potential.

POPPET TYPE VALVES


Direct mechanical action without pilot or diaphragm actuation.
Rugged stem, proper guiding and small packing surface result in minimum maintenance.
Micrometer-like adjustment for very close regulation at low flow rates.
Quick and simple adjustment of pressure control.
Valve seat is welded in for high pressures.
Poppet construction assures tight seating without critical adjustment.
Stellited seating surfaces are available.
CLOSED
OPEN

Demands on a soot blower valve are extremely severe . . . performance requirements very high. Long experience has shown that the poppet type valve is the most satisfactory unlubricated valve for such rugged work. (It is also used in automobile engines.) The Diamond Poppet Type has proved its superiority by many years of successful operation on the most difficult jobs . . . it is an important factor in the outstanding performance of the blowers shown on the opposite page.

Construction assures tight seating without close adjustments. Valve seat is welded in for high pressure service and Stellite seating surfaces are available for conditions that require them. The valve readily lends itself to examination and repair. Disc and seat are quickly accessible, and regrinding can be done quickly without dismounting the head. Seat and disc are forged and the stem rolled from stainless steel.

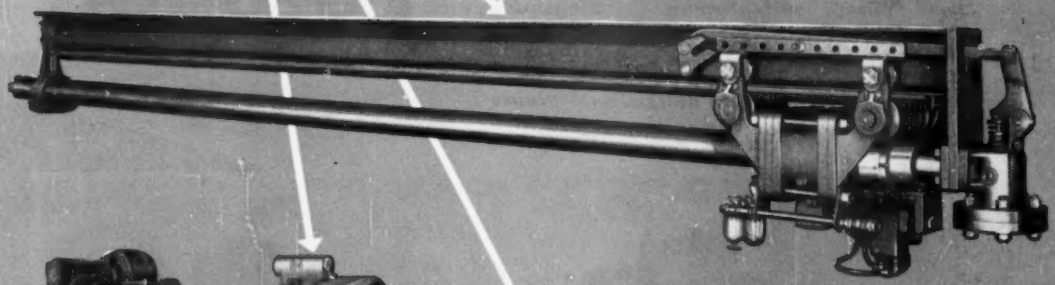
The integral adjustable pressure control device is used when boiler pressure is higher than desirable for blowing . . . but not so extreme as to require a separate pressure reducing valve. It is easily and quickly adjusted . . . consists of a ribbed disc carried on the threaded valve stem guide. Its location outside the path of valve travel permits full and immediate opening of the poppet valve, thus avoiding wire drawing.

This valve construction is one of the many reasons why Diamond blowers give better boiler cleaning at lower cost.

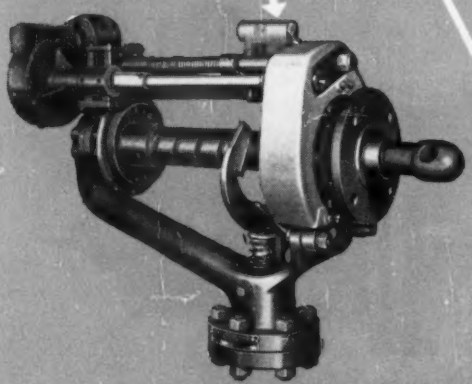
Model IK valve shown above; Models IR and 698 valves have same advantages.

4359

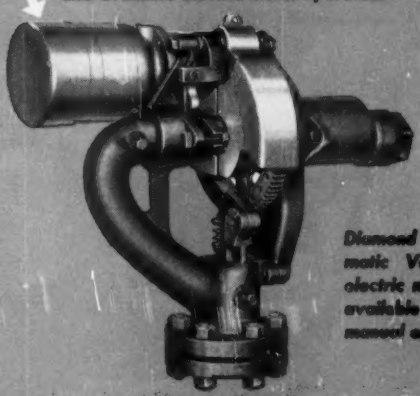
An IMPORTANT REASON for the better performance of these DIAMOND Blowers



Diamond Model IK Long Retracting Blower with mechanically operated valve. Air motor operated unit shown; also available electric motor operated.



Diamond Model IR Short Retracting Blower with air motor operation; electric or manual operation also available.



Diamond Model G98 Automatic Valved Blower with electric motor operation; also available with air motor or manual operation.

DIAMOND POWER SPECIALTY CORPORATION
LANCASTER, OHIO
Diamond Specialty Limited • Windsor, Ontario

Space-saving rugged

Built, shipped and installed as a compact unit, the new Elliott geared turbine has many advanced features that fit it to the most exacting requirements. Here are some of them:

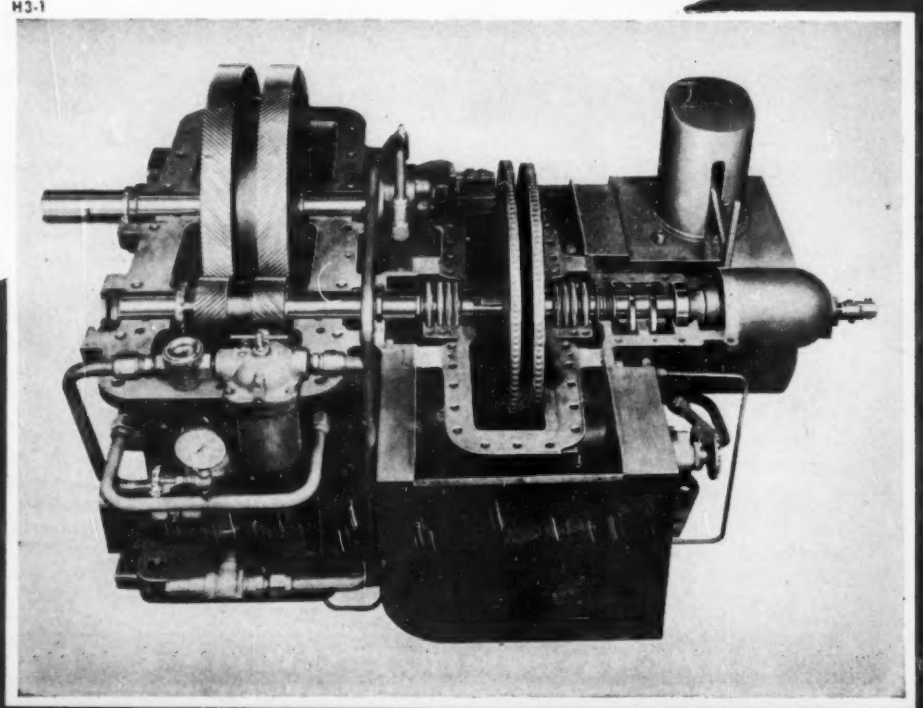
- **Turbine wheels and pinions mounted on a single sturdy high-speed shaft—**
- **Double-helical gears and pinions eliminate end thrust and the need for maintaining critical thrust bearing.**
- **Requires no base plate or external oil reservoir. Three-point support.**
- **Neatly arranged lubrication system, with all external oil piping connected to lower casing.**
- **Liner-type bearings . . . gear-type oil pump, self-priming . . . Kingsbury floating-ring type oil seals with slingers.**

Also built in coupled design, with pinion shaft flexibly coupled to the turbine.

only one of many vital factors in the new

ELLIOTT Geared Turbine

H3-1



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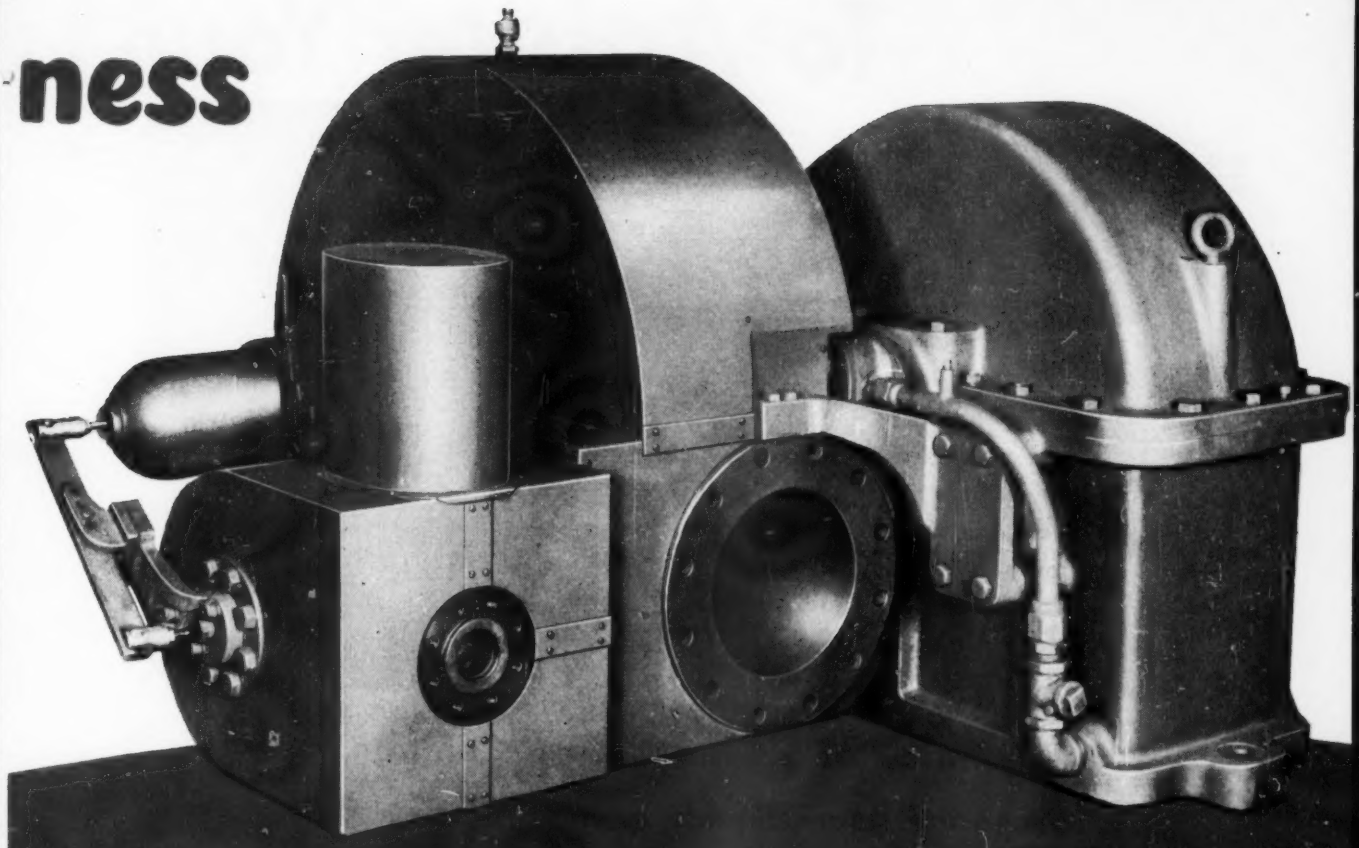


THE TURBINE

The new "built-in" Elliott geared turbine employs the sturdy and dependable YR turbine. This proved turbine design is adaptable to practically all operating requirements and is economical in both operation and maintenance.

Outstanding features are centerline support, stainless steel turbine buckets and shrouds, dynamically balanced rotors, and the choice of several governors to be used with the standard overspeed governor. The wide use of standardized parts thru small sizes of YR turbines simplifies maintenance and the stocking of parts.

Full details on the new Elliott Geared Turbines are given in Bulletin G-15. Bulletins G-14 and G-16 describe the YR turbine line. Contact your local Elliott district office or write Elliott Company, Jeannette, Pennsylvania.

THE GEARS

Gear and pinion are double-helical (herringbone) type, precision-hobbed, quiet, and long wearing. Tooth spacing is held to extremely close tolerances. Conservative proportioning of the teeth minimizes pinion deflection and permits a uniform, low tooth load.

Both the high-and low-speed gear shafts are provided with an oil slinger combined with a special seal. This design prevents leakage of oil from the gear case and eliminates the infiltration of water, steam, or impurities into the gear case.

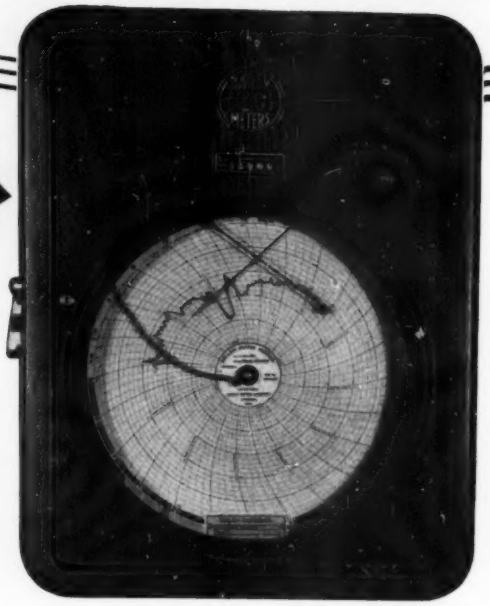
All Elliott gears, built-in or coupled, include a self-contained, forced-feed lubrication system which circulates oil under pressure to the gear and pinion bearings. In addition, two spray nozzles in the gear casing direct a sheet of oil continuously into the meshing point of the gear and pinion teeth, cooling the teeth and lubricating the contact area.

ELLIOTT Company

STEAM TURBINE DEPT.

To Answer Your

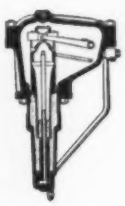
LOOK HERE



This standard Bailey Recorder actuated by mechanical, electrical, or pneumatic transmission solves even your toughest problems in flow measurement and control.

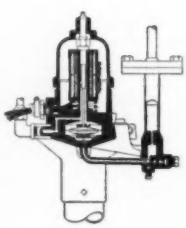
YOUR Choice of 7 Measuring Components:

...To measure steam, liquids, or high pressure gases in pipes use:



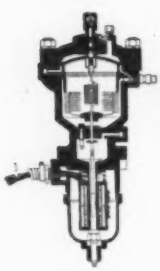
1 Ledoux Bell—

This shaped bell floating in mercury insures high accuracy and dependability throughout entire meter range. Records on uniformly graduated chart. For static pressures up to 2500 psig.



2 Mercury Float—

Actuates electric transmitter which has interchangeable range tubes. Electronic receiver records on uniformly graduated chart. For static pressures up to 2500 psig.



3 Bellows—

Actuates electric transmitter which requires no mercury, is readily portable and is easily adjustable to a wide variety of ranges. Electronic receiver records on uniformly graduated chart. For static pressures up to 3500 psig.

Bailey Meter Company

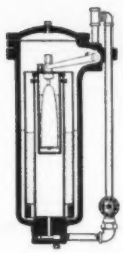
Flow Problems

...To measure liquids in pipes use:

4 Area Meter—

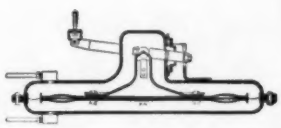
Variable area constant differential orifice actuates electric transmitter. For 1, 2 or 4″ lines in capacities from 1200 to 96,000 lb per hour and static pressures up to 600 psig.

...To measure low pressure gases in pipes and ducts use:



5 Inverted Bell—

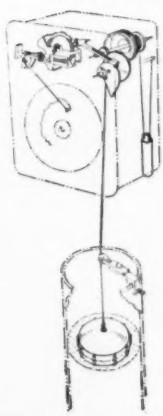
Sizes up to 12″ diameter furnish ample power with differentials as low as 2″ H_2O. Shaped displacer floating in mercury provides for uniformly graduated chart. Static pressure limits vary from 50 to 800 psig, depending upon bell size.



6 Diaphragm—

44 square inches in area opposed by shaped displacer floating in mercury actuates uniformly graduated chart recorder. Suitable for differentials from .5″ to 7″ H_2O and static pressures up to 70″ H_2O.

...To measure liquids in open channels use:



7 Open Float—

Actuates uniformly graduated chart recorder through pulley-operated cam and gear train. May be calibrated to any maximum head between 5″ and 360″ of liquid flowing in channel.

•

Ask your local Bailey Engineer to assist you in applying Bailey Meters to your measurement and control problems.

C-8

1036 Ivanhoe Road
CLEVELAND 10, OHIO

Meters and Controls For Power and Process

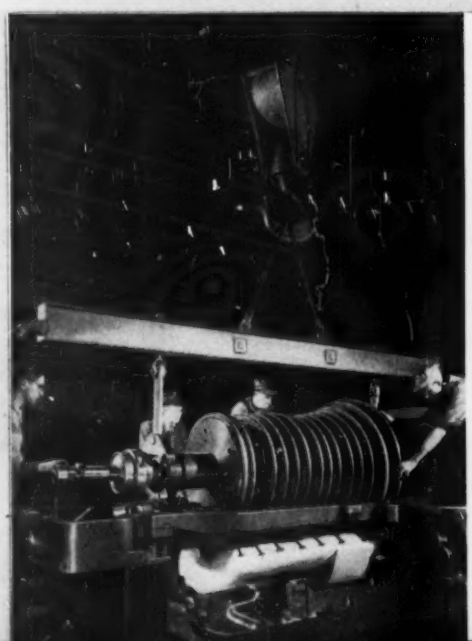
From Shop

HERE'S HOW Allis-Chalmers Builds the Generator Unit that's Easy to Install, Low in Foundation Cost

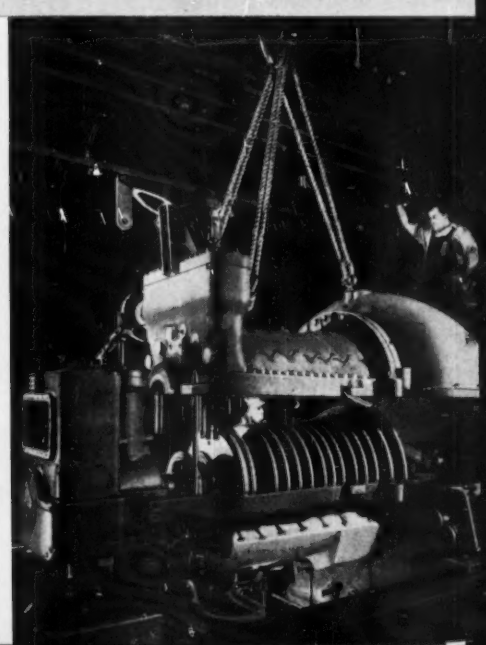
MODERN Allis-Chalmers WA-Series steam turbine generating units are factory tested and shipped with rotors locked in place to save you installation time. Oil piping and generator air coolers are both above the floor line to reduce your foundation costs.

WA-Series units are built in ratings from 2000 to 7500 kw for either condensing or non-condensing operation. For your copy of Bulletin 03B7654, call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3910

1 Precision balanced turbine rotor assembly being lowered into casing. All wheels have durable chrome alloy steel buckets.



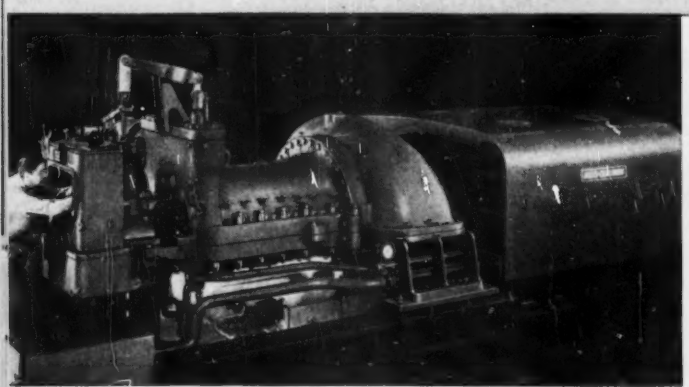
2 Upper half casing of this compact impulse steam turbine is next added in the process of assembling the WA-Series unit.

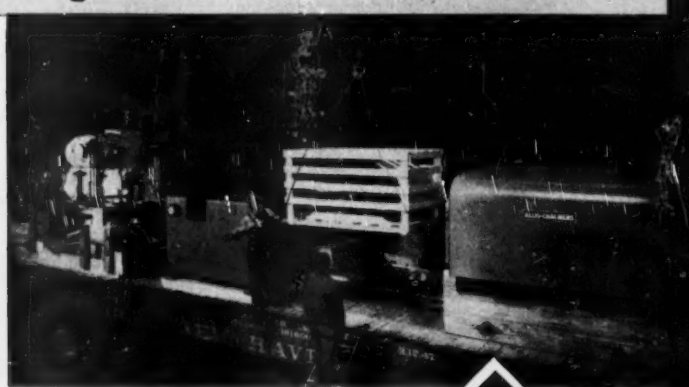


to Shipment!

3 Assembled 3-bearing unit — complete with housing type air cooled generator — ready for factory testing. Both oil piping and generator air coolers are above the floor line.

4 Entire WA-Series 3000-kw unit—pre-tested and insulated—being loaded on **one** flatcar for unit shipment. Both turbine and generator are shipped with their rotors securely locked in place.





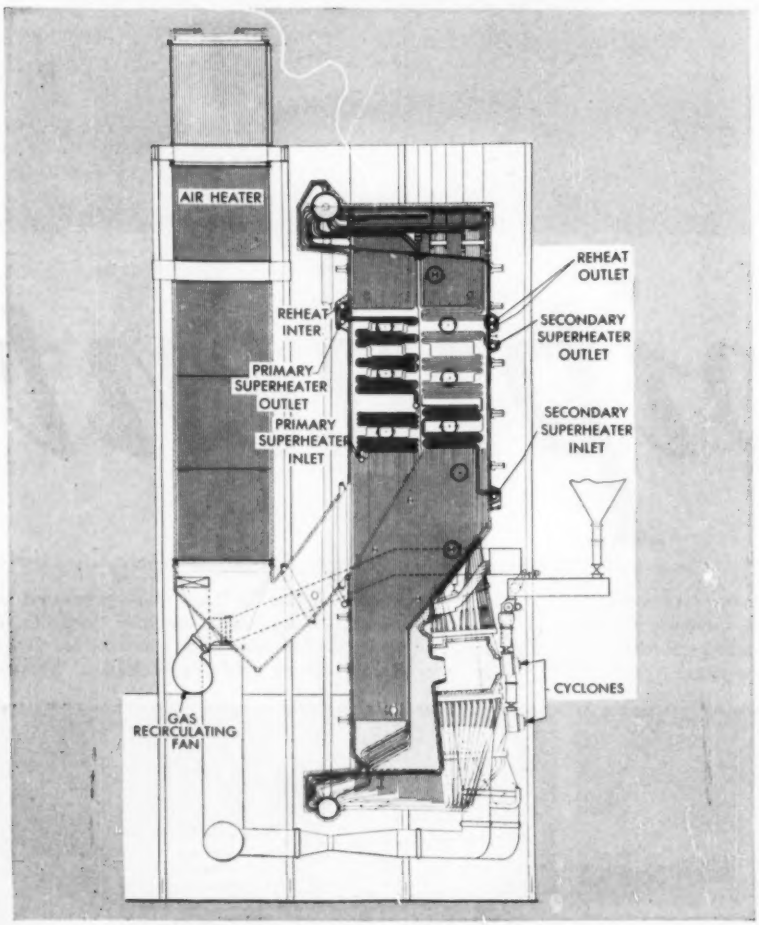
ALLIS-CHALMERS

World's Widest Range of Power Plant Equipment

A-C ALLIS-CHALMERS

OHIO EDISON COMPANY

for Two Cyclone-fired pressurized-furnace



Steam Generators (2)..Babcock & Wilcox

Type.....Radiant, with reheater

Maximum Capacity....885,000 lb per hr

Superheater Outlet Pressure....1485 psig

Final Superheated Steam Temperature 1000 F

Reheat Steam Temperature.....1000 F

Fired with.....Crushed coal; cyclone fired, pressurized furnace

Soot Blowing..Vulcan Automatic-Sequential System with air-powered long retracts and electric-driven traveling-frame air-preheater cleaners. Blowing medium for all units: air.

Design Engineers.....Commonwealth Associates, Incorporated

VULCAN *Automatic*

INSTALLS VULCAN

reheat steam generators at NILES STATION

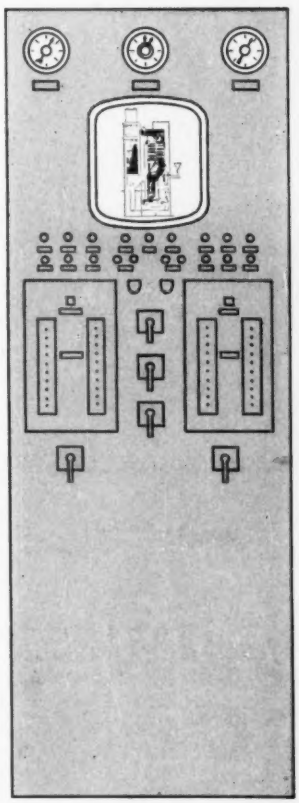
PLANNED for functional design and operating efficiency, the new Niles Station will add 212,000 kilowatts to Ohio Edison Company's system capacity.

Boiler cleaning will be by Vulcan long retractables and traveling-frame—indexing and air-blasting—air-preheater cleaners They are designed to keep even the most inaccessible areas free from deposits that would cut boiler efficiency.

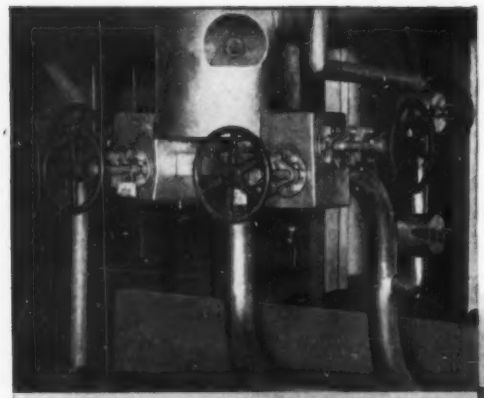
Whether your boilers be large or small, utility or industrial, power or process—depend on Vulcan to clean them effectively, at low overall cost.

And Vulcan Automatic-Sequential Control will reduce soot blowing to a mere matter of setting up the program at a central panel.

COPES-VULCAN DIVISION
CONTINENTAL FOUNDRY & MACHINE COMPANY
ERIE, PENNSYLVANIA

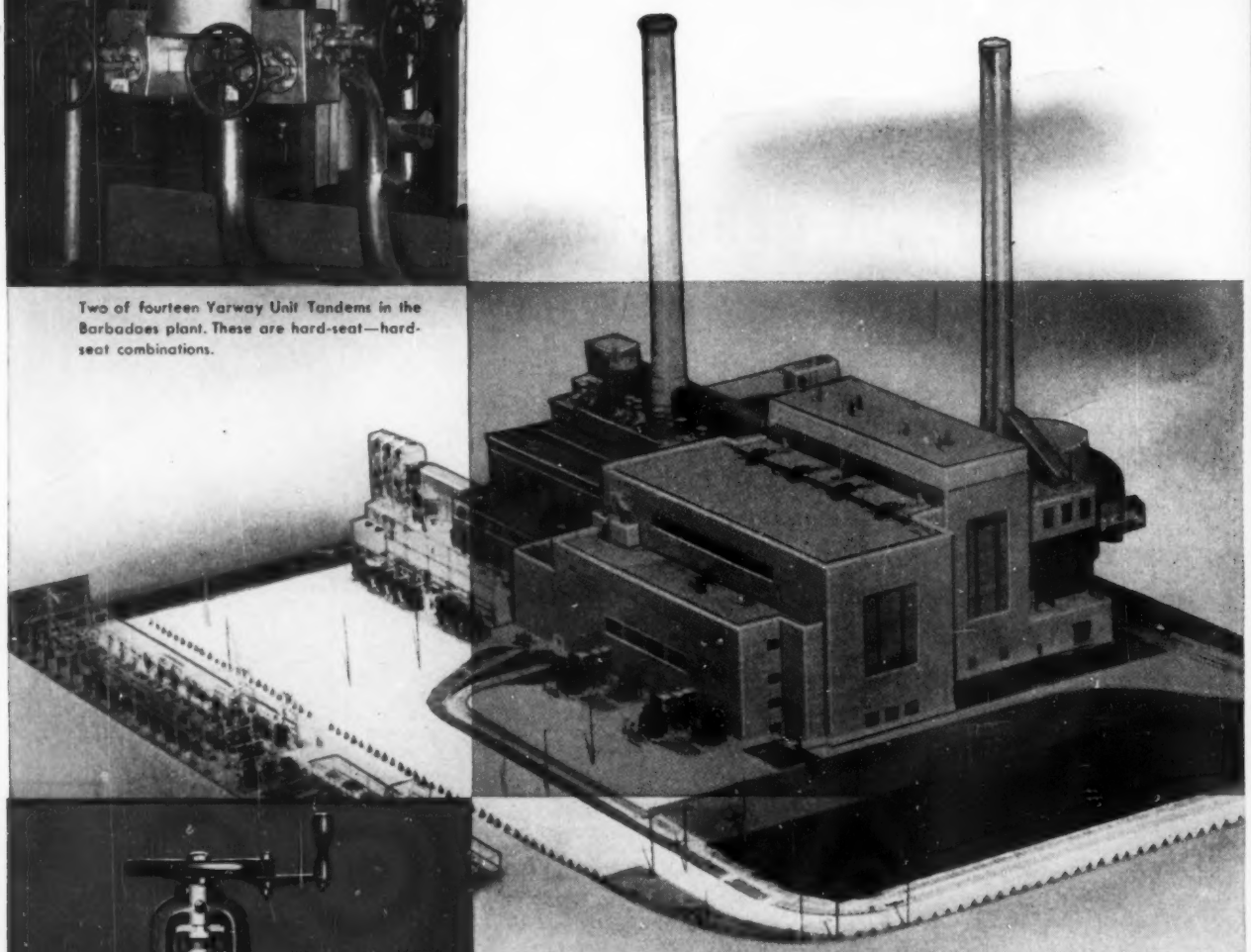


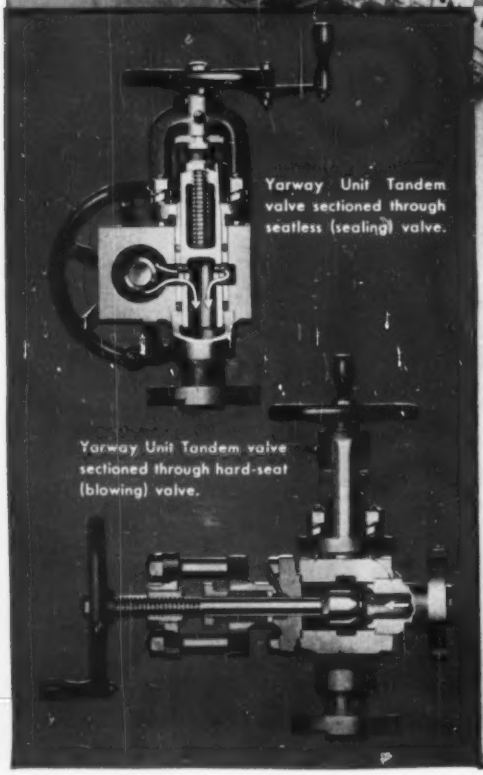
The operator sees the report of each blower as it works in automatic or selective sequence, or manually, as he pushes the right button.



Two of fourteen Yarway Unit Tandems in the Barbadoes plant. These are hard-seat—hard-seat combinations.

BARBADOES BOILERS GET





Yarway Unit Tandem valve sectioned through seatless (sealing) valve.

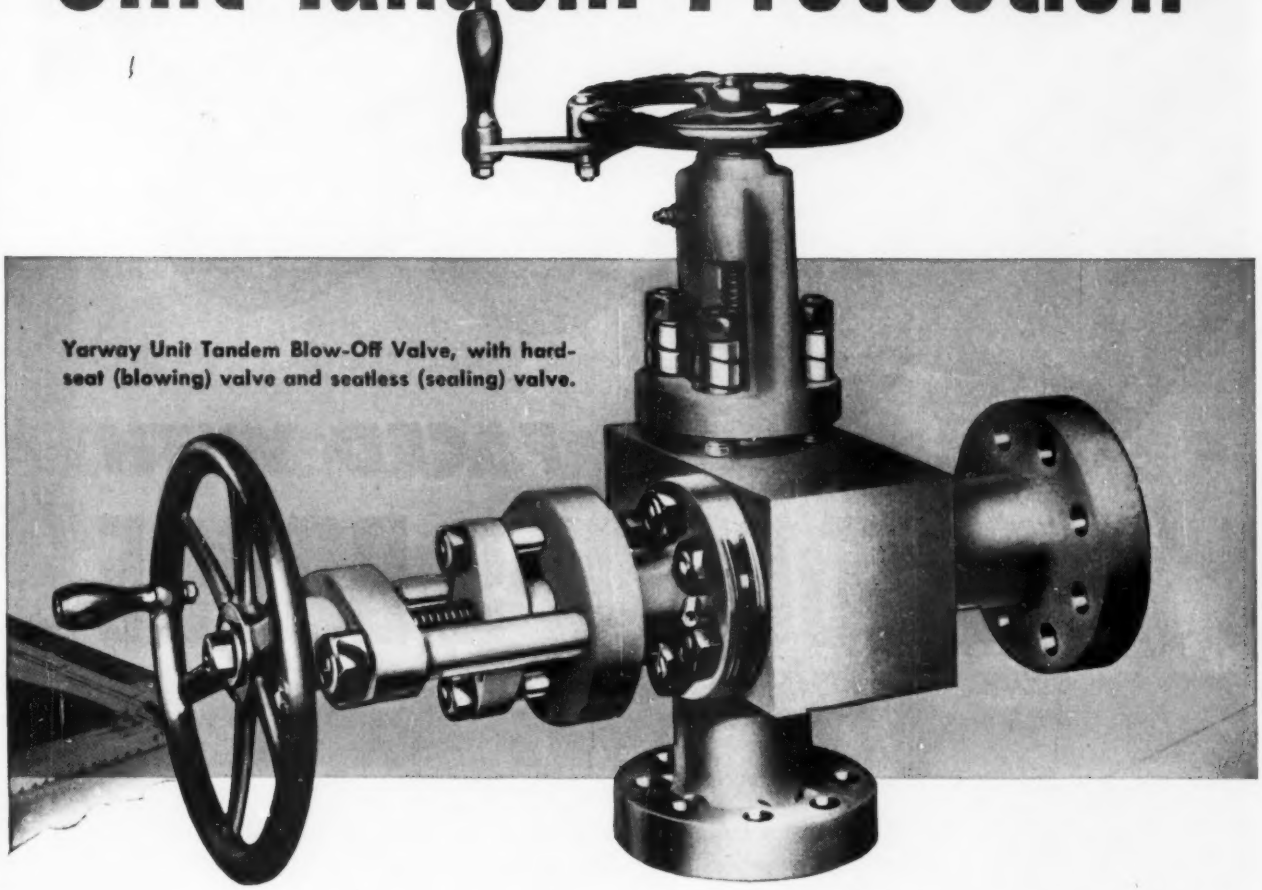
Yarway Unit Tandem valve sectioned through hard-seat (blowing) valve.

■ When a company has a $25,000,000.00 stake in the future such as Philadelphia Electric Company does in its Barbadoes Station —then protects the boilers of that plant with Yarway Unit Tandem Blow-Off Valves—it's significant of the dependability of those valves.

Barbadoes is a fine example of modern power plant engineering, demonstrated by the fact that only 11 men per shift are needed for operating this 180,000 KW station.

YARWAY

Unit Tandem Protection



Yarway Unit Tandem Blow-Off Valve, with hard-seat (blowing) valve and seatless (sealing) valve.

Yarway Unit Tandem Blow-Off Valves also are a good example of steam equipment engineering—used in more than 4 out of 5 high pressure boiler plants in the country.

Rugged construction makes Yarways strong and tough enough to withstand severest blow-down conditions. Metallurgical improvements make them resistant to the reactions of periodic acid wash. *Outages are rare where Yarway boiler valves are used.*

Unit tandems are available in various combinations to meet all pressure and service requirements.

Write for Bulletin B-433 for full details on Yarway Unit Tandems. For lower pressure blow-off valves, write for Bulletin B-424.

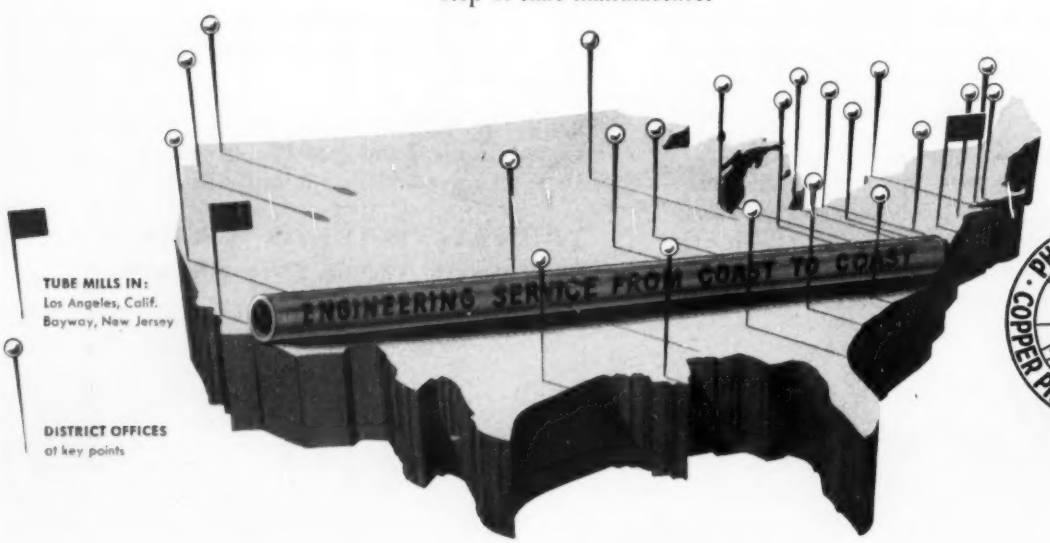
YARNALL-WARING COMPANY
101 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

STEAM PLANT EQUIPMENT

FACED WITH

PUT PHELPS DODGE

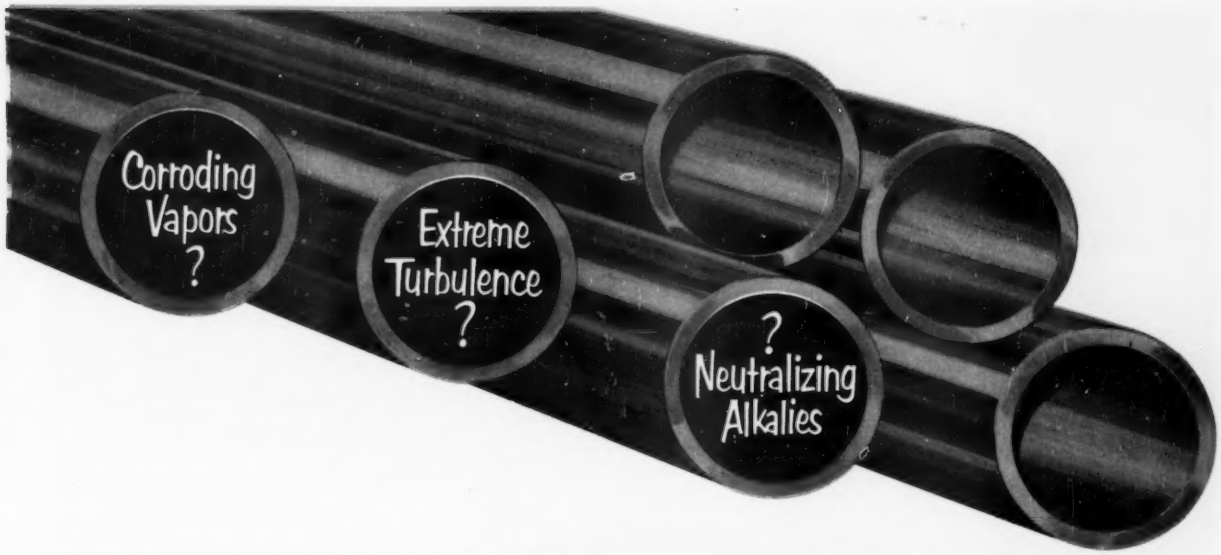
- *Condenser tube specialists* with years of experience in solving tough tube-operation problems.
- *Pioneers* in "trouble-shooting" service nationwide. Research personnel and facilities second to none.
- *Highest quality*—assured by Phelps Dodge Hot-Forged, Extrusion Process and exacting mill control through every step of tube manufacture.



TUBE MILLS IN:
Los Angeles, Calif.
Bayway, New Jersey

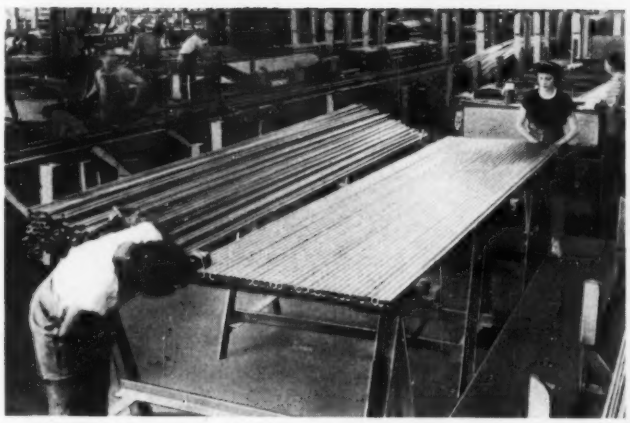
DISTRICT OFFICES
at key points

PHELPS DODGE COPPER PRODUCTS CORPORATION
MINE TO MARKET
P D

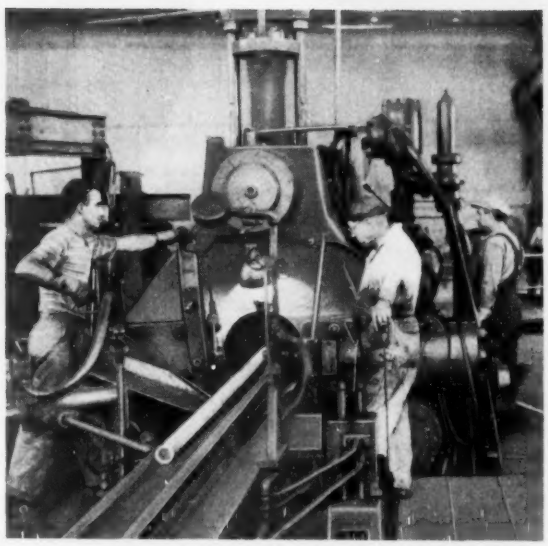


CONDENSER TUBE PROBLEMS?

"KNOW-HOW" TO WORK!



Condenser tubes are pressure tested and inspected for quality control.

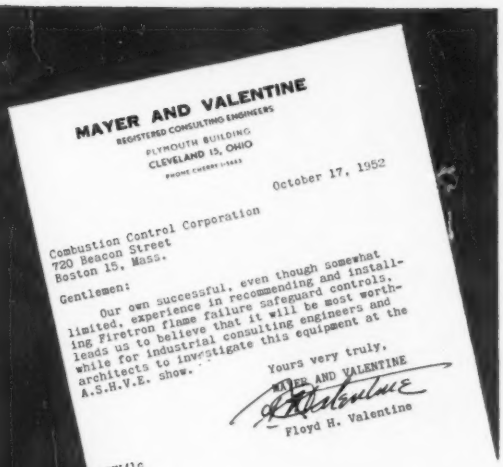


Partially extruded tube—the first step in producing tubes.

PHELPS DODGE COPPER PRODUCTS CORPORATION

40 WALL STREET, NEW YORK 5, N. Y.

NOW
universal
acceptance
Safe, fully automatic
operation of
commercial and
industrial gas and
oil burners with
firetron
The Fireye that sees all flames
fireye
FIREYE flame-failure safe-
guards and programming
controls for automatic and
manually fired burners.



MAYER AND VALENTINE
REGISTERED CONSULTING ENGINEERS
PLYMOUTH BUILDING
CLEVELAND 15, OHIO
PHONE CHERRY 1-5883

October 17, 1952

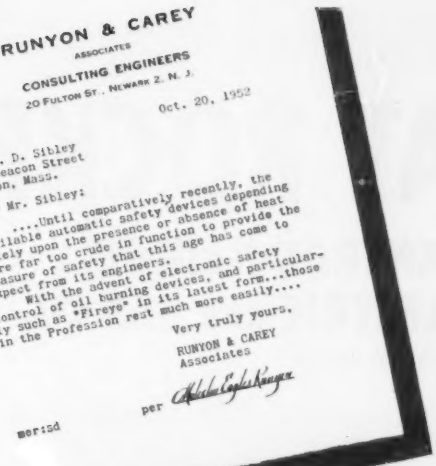
Combustion Control Corporation
720 Beacon Street
Boston 15, Mass.

Gentlemen:

Our own successful, even though somewhat limited, experience in recommending and installing Firetron flame failure safeguard controls, leads us to believe that it will be most worthwhile for industrial consulting engineers and architects to investigate this equipment at the A.S.H.V.E. show.

Yours very truly,
MAYER AND VALENTINE
Floyd H. Valentine

FHV/lc



RUNYON & CAREY
ASSOCIATES
CONSULTING ENGINEERS
20 FULTON ST., NEWARK 2, N. J.

Oct. 20, 1952

Mr. L. D. Sibley
720 Beacon Street
Boston, Mass.

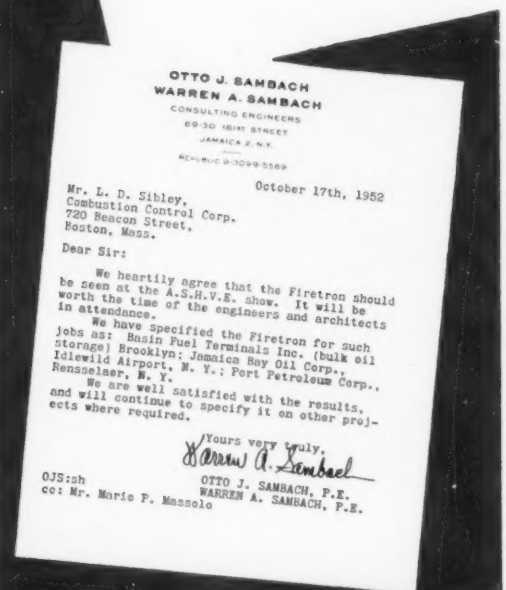
Dear Mr. Sibley:

....Until comparatively recently, the available automatic safety devices depending solely upon the presence or absence of heat were far too crude in function to provide the measure of safety that this age has come to expect from its engineers.

With the advent of electronic safety control of oil burning devices, and particularly such as "Fireye" in its latest form...those in the Profession rest much more easily....

Very truly yours,
RUNYON & CAREY
Associates
per

mer:sd



OTTO J. SAMBACH
WARREN A. SAMBACH
CONSULTING ENGINEERS
89-30 161st STREET
JAMAICA 2, N.Y.
REPUBLIC 9-3099-5569

October 17th, 1952

Mr. L. D. Sibley,
Combustion Control Corp.
720 Beacon Street,
Boston, Mass.

Dear Sir:

We heartily agree that the Firetron should be seen at the A.S.H.V.E. show. It will be worth the time of the engineers and architects in attendance.

We have specified the Firetron for such jobs as: Basin Fuel Terminals Inc. (bulk oil storage) Brooklyn; Jamaica Bay Oil Corp., Idlewild Airport, N. Y.; Port Petroleum Corp., Rensselaer, N. Y.

We are well satisfied with the results, and will continue to specify it on other projects where required.

Yours very truly,
OTTO J. SAMBACH, P.E.
WARREN A. SAMBACH, P.E.

OJS:sh
cc: Mr. Mario P. Massolo

. . . We consulting engineers and architects are always on the lookout for new developments and, in our opinion, it would be very valuable to have the Firetron unit exhibited at the show in Chicago. It should be most interesting and informative to everyone attending.

SCHMIDT, GARDEN & ERIKSON
Architects-Engineers, Chicago, Ill.
Gerald C. Dittman, *Chief Engineer*

. . . We are planning to visit your booth at the A.S.H.V.E. show and listen to the Firetron story. In our work, it is necessary to be cognizant of improvements in equipment, as incorporated in your new FP controls.

VERN E. ALDEN COMPANY
Engineers, Chicago 2, Illinois
A. C. Soderholm, *Project Engineer*

. . . In our opinion, the Firetron is an important new aid in the field of flame failure safeguards that warrants careful consideration by members of the A.S.H.V.E.

We would certainly recommend that the Firetron exhibit be seen at the show in Chicago.

ROBERT E. HATTIS
Consulting Engineers, Chicago, Ill.
Per R. C. Helden

. . . We think it most worthwhile to learn about Firetron at the A.S.H.V.E. show. We cannot imagine any who will not want to know more about this new tool in the field of industrial flame failure safeguard controls.

FRED L. MOESEL ASSOCIATES
Consulting Engineers, New York, N.Y.
Per L. Gemmola

See FIREYE systems demonstrated . . . test them yourself . . . get full details of successful installations on all types of burners.

AT BOOTH NUMBER 538-540

International Heating & Ventilating Exposition
International Amphitheatre, Chicago, Illinois

January 26-30, 1953

Combustion Control Corporation

720 Beacon Street, Boston, Mass.

Factory sales and service offices in all parts of the United States.

AT ROCKFORD

CENTRAL ILLINOIS ELECTRIC AND GAS CO.
Rockford, Illinois

It's Detroit Rotograte

Detroit RotoGrate Stoker ready for shipment to Sabrooke Station.

FOUR CONTRACTS FOR TWO STATIONS

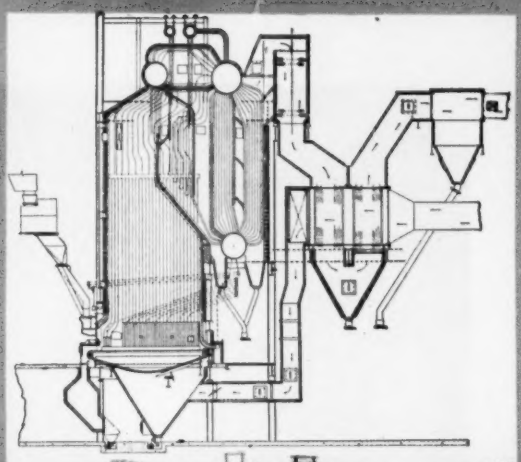
Stone & Webster Engineering Corporation
Engineers and Constructors

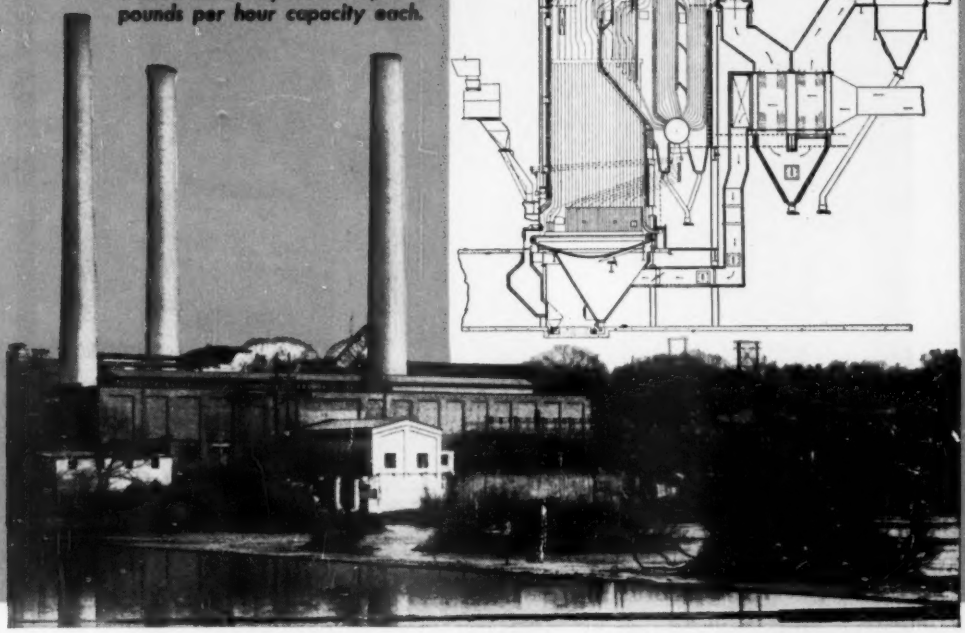
960,000 Pounds of Steam per Hour total Capacity

Write for complete information on Detroit RotoGrate Stokers.

EXTENDING FORDAM STATION

This side elevation of stoker and generator with economizer and air heater is typical of the Fordam and Sabrooke Station installations which have up to 300,000 pounds per hour capacity each.





Fordam Station Rockford, Illinois

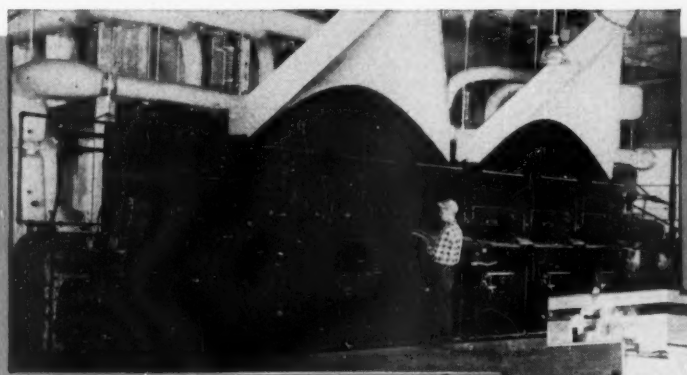
Detroit RotoGrate Stokers were selected for the new boilers in the Fordam and Sabrooke Stations at Rockford:

FIRST because they efficiently burn any type of bituminous coal. SECOND because of the lower investment necessary in equipment, foundations and building. THIRD because of lower power consumption to operate both stokers and auxiliaries and lower maintenance with a minimum of slagging difficulties in the furnace.

RotoGrate Stokers are modern spreader stokers with grates that move slowly forward, discharging the ash at the front. They permit high burning rates to produce more capacity per foot of furnace width.

At Rockford, as well as hundreds of other plants, they are operating at highest efficiency—with greatest satisfaction.

Interior of Sabrooke Station shows number one unit.



NEW SABROOKE STATION

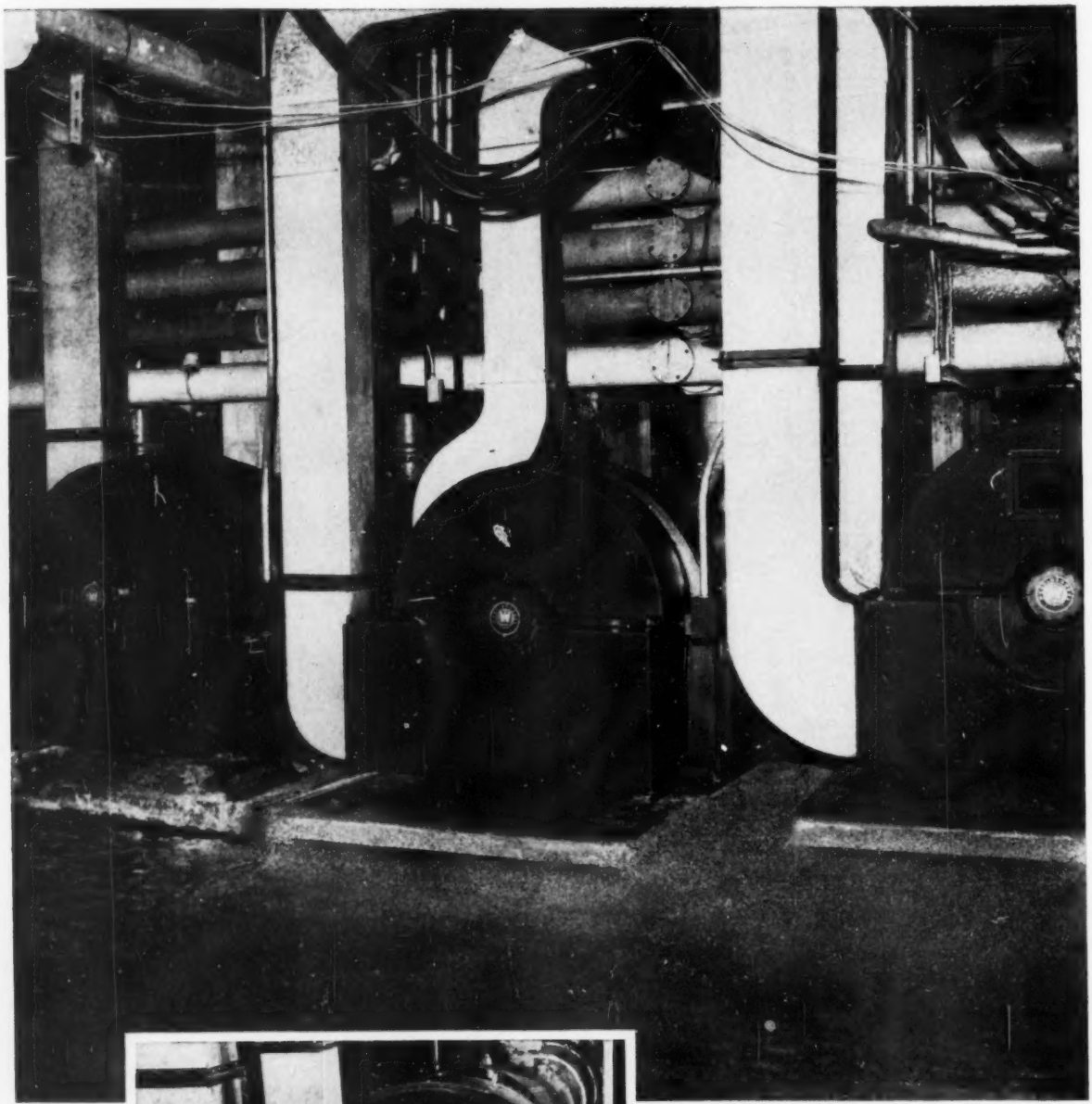
Sabrooke Station— Rockford, Illinois

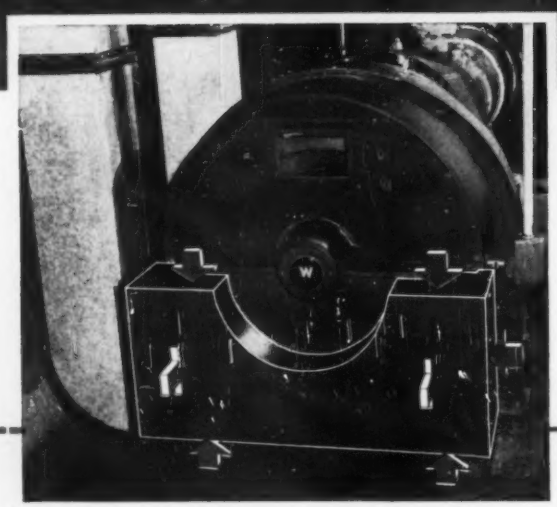
DETROIT SINCE 1898 STOKERS

DETROIT STOKER COMPANY

General Motors Building—Detroit 2, Michigan

District Offices in Principal Cities • Works at Monroe, Michigan





The above is a typical forced-ventilated installation. These same ducts could have been brought into these motors from any angle as shown by the arrows on the inset at the left.

WHERE FORCED VENTILATION IS REQUIRED . . .

Westinghouse Air Inlet Brackets Offer Complete Flexibility of Installation

From the top, bottom, front or either side . . . ventilating ducts or pipes may be brought in from practically any angle to this forced-ventilated, large induction motor. It's the ventilation system and design of the air inlet brackets that make this possible.

Ventilating air is supplied to the motor from both ends through the two air inlet brackets. These brackets can be supplied with duct or pipe connections located on any of the exposed surfaces. Thus, many installation problems are eliminated and the motor can be positioned without regard to the space available for duct work.

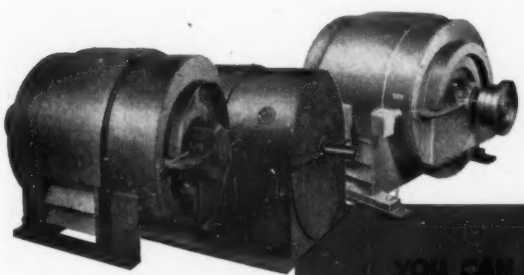
The ventilating air is discharged from both sides of the motor through louvered openings. If desired, these openings can also be housed so that the exhausted air can be routed away through similar ducts or pipes.

Other important Westinghouse features that you will want to consider in selecting your next large induction motor are:

- Bearing construction and end enclosures make bearing inspection, cleaning, servicing and replacement as easy as on a standard open motor.
- Welded steel construction to form a sturdy frame.
- Insulation of great dielectric strength and high heat resistance for long life.
- All-metal rotors are dynamically balanced for quiet, smooth operation.

Ask your Westinghouse representative about all the details of this improved large motor or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-10356



Also available are these three types of large induction motors. Open dripproof motors for general service. Outdoor motors for service in the open weather. Splashproof motors for protection against falling liquids or solid particles.

YOU CAN BE SURE . . . IF IT'S Westinghouse

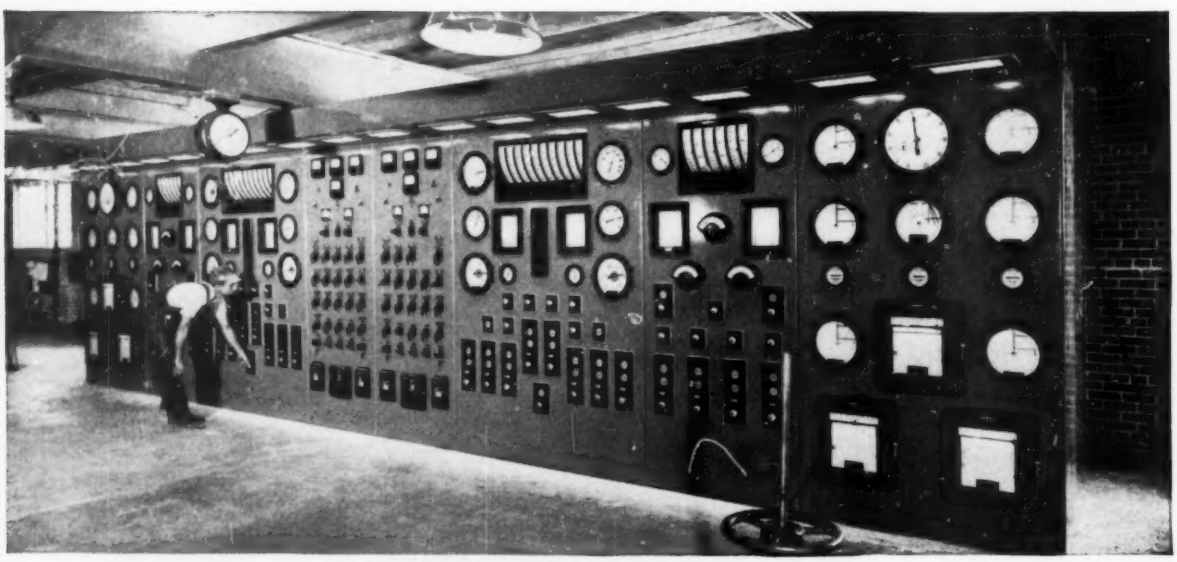
LARGE INDUCTION MOTORS

REPUBLIC
Combustion Control Systems

AN automatic combustion control system, as designed and built by Republic, will enable you to operate your boiler (or boilers) over a long period at test efficiencies regardless of variations in fuel, load and other operating factors.

Republic combustion control is a unified system controlling the fuel and air supply to the boiler in the correct amount to maintain constant steam pressure and in the correct ratio to maintain maximum combustion efficiency.

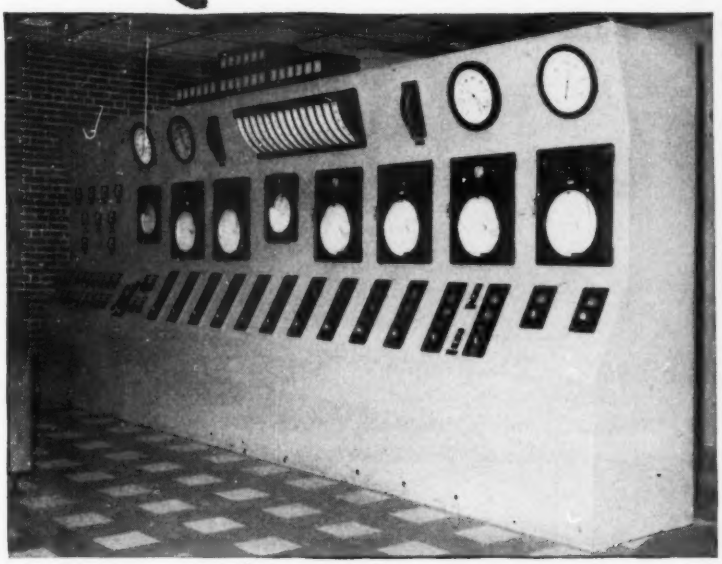
Republic automatic combustion control systems, either pneumatic or hydraulic, are available for all sizes of boilers, all types of fuel firing, and load conditions and any arrangement of draft equipment. They are completely described in Data Book No. S-21—write for your copy.



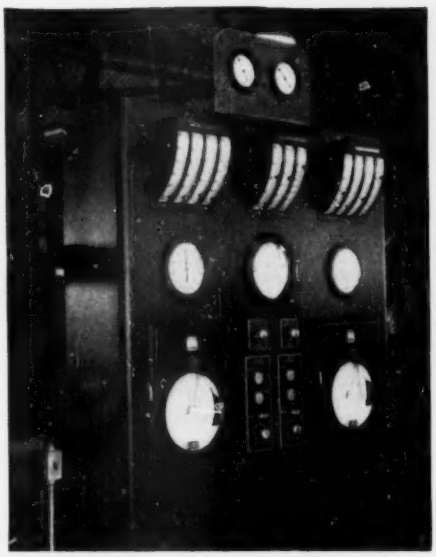
PULVERIZED COAL
In this modern central station steam is generated in two 600,000 lbs. per hr. pulverized coal fired boilers operated by a Republic Combustion Control System.

REPUBLIC FLOW METERS CO.
2240 Diversey Parkway, Chicago 47, Illinois

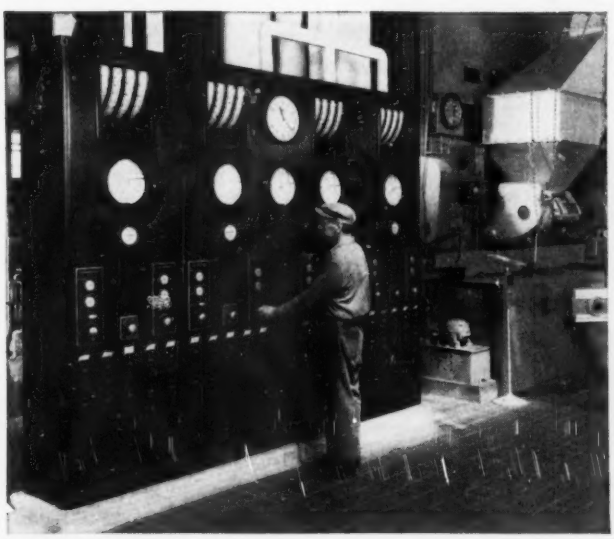
for { All Sizes of Boilers / All Types of Firing / All Arrangements of Draft / All Load Conditions



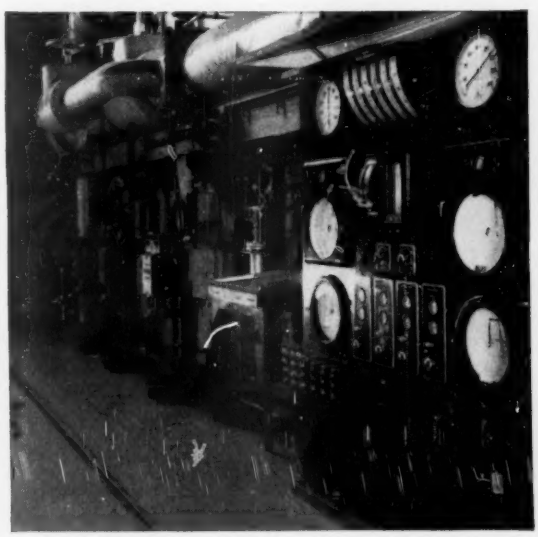
OIL FIRED
A typical Republic automatic boiler control and instrument installation in a large central station for the operation of a 450,000 lb. per hr. oil fired boiler.



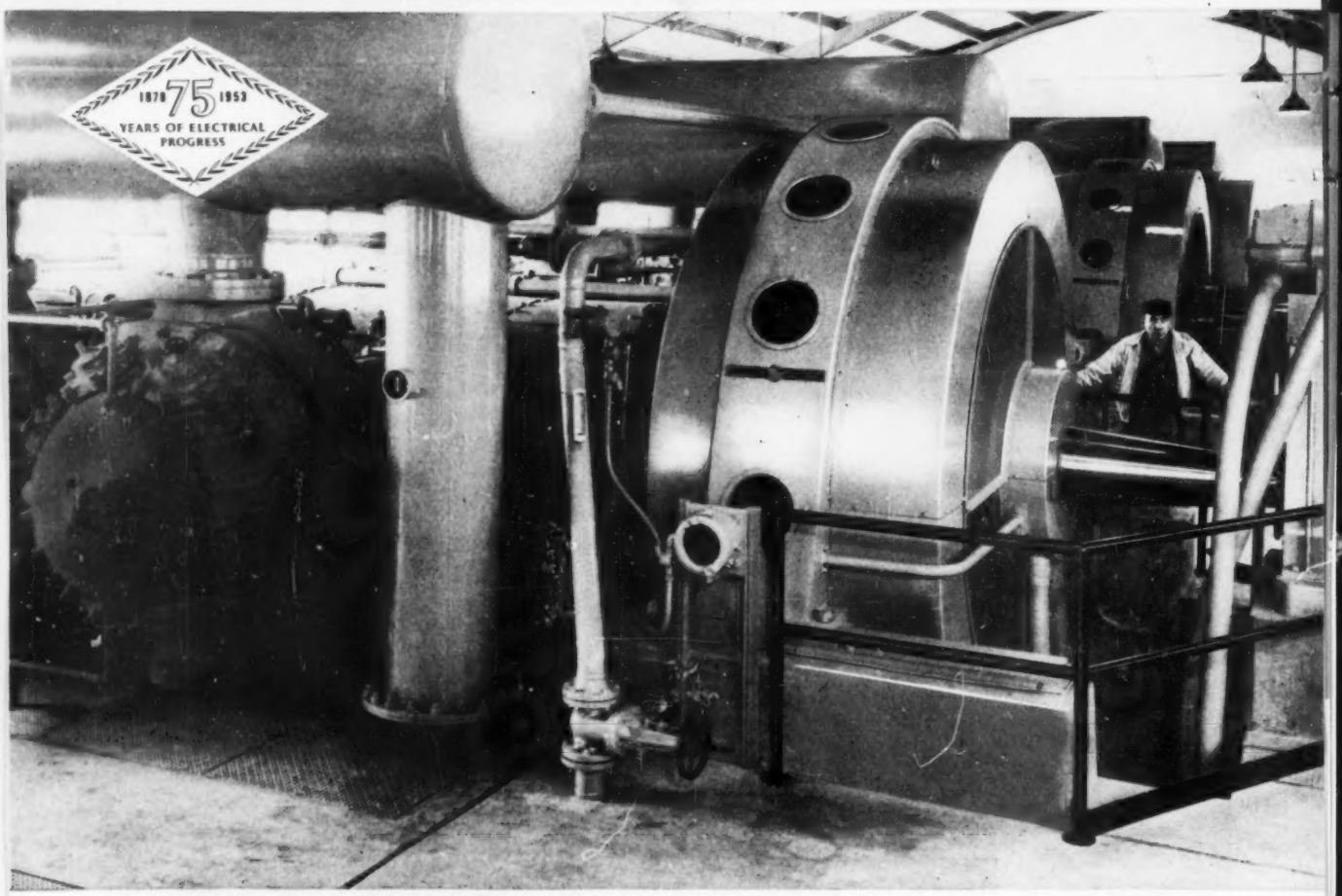
MIXED GAS
Republic instrument and controls for two 50,000 lb. per hr. boilers burning mixed gas.



STOKER FIRED
The Republic combustion control and instrument panel for the automatic operation of four 80,000 lb. per hr. stoker fired boilers.

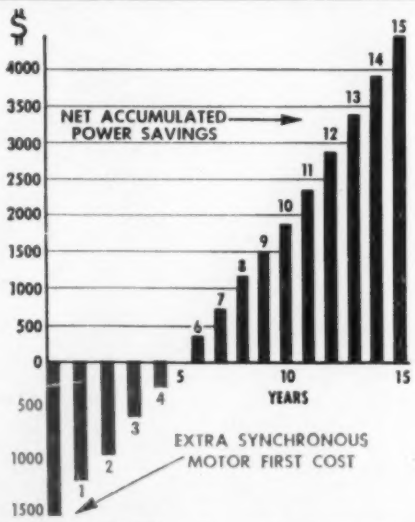


STOKER FIRED
In this modern industrial plant steam is generated in a 175,000 lb. per hr. stoker fired boiler operated by a Republic control system.



COMPRESSORS IN A GAS STORAGE STATION are driven by General Electric 3000 hp, 300 rpm synchronous motors.

Can synchronous motors cut

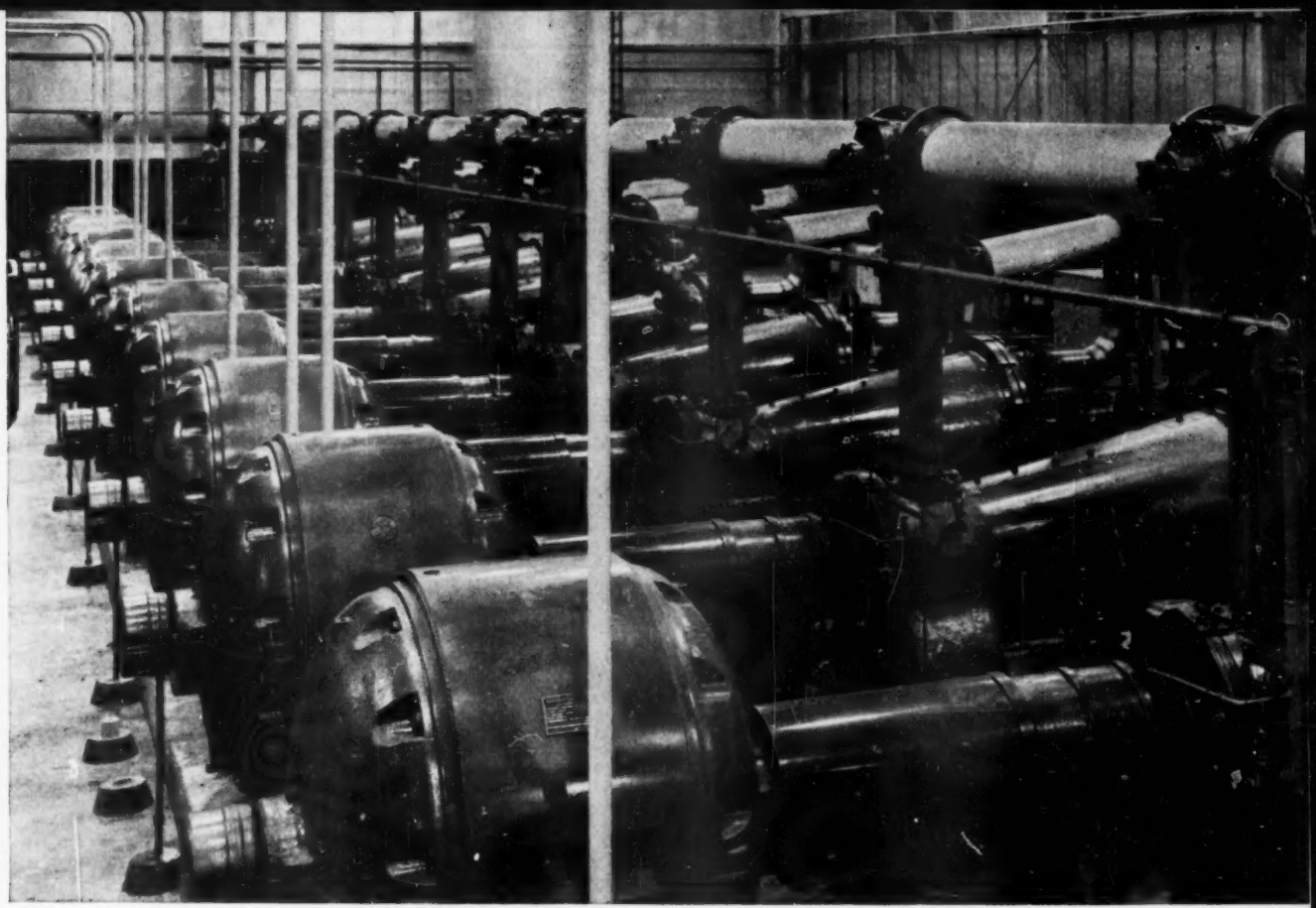


OPERATING SAVINGS on the synchronous motor application described above are shown over a period of twenty years. Extra first cost will be amortized in five years; savings will continue for many more.

Here's how one plant saves with a G-E Synchronous Motor

The specifications for a new pump motor were 250 hp, 600 rpm, 2300 volts, 3 phase, 60 cycle. The price of a 1.0 Power Factor synchronous motor, including exciter and control, was higher than an equivalent squirrel-cage induction motor with control. However, the synchronous motor efficiency, including exciter loss, was 1.6% higher than the induction motor (93.0% vs 91.4%). Since the motor was to operate continuously at a power cost of 11 mils per kilowatt-hour, it was found that the power savings would repay the additional investment in only five years. The operating savings will continue throughout the life of the motor—10, 20, even 30 years.

Savings such as these make synchronous motors the most economical drive for many heavy-duty, continuous-service applications. And in many cases, synchronous motors are lowest in first cost, too.



GENERAL ELECTRIC 400 HP SYNCHRONOUS MOTORS are coupled to ten Jordans in a paper mill.

your plant's operating costs?

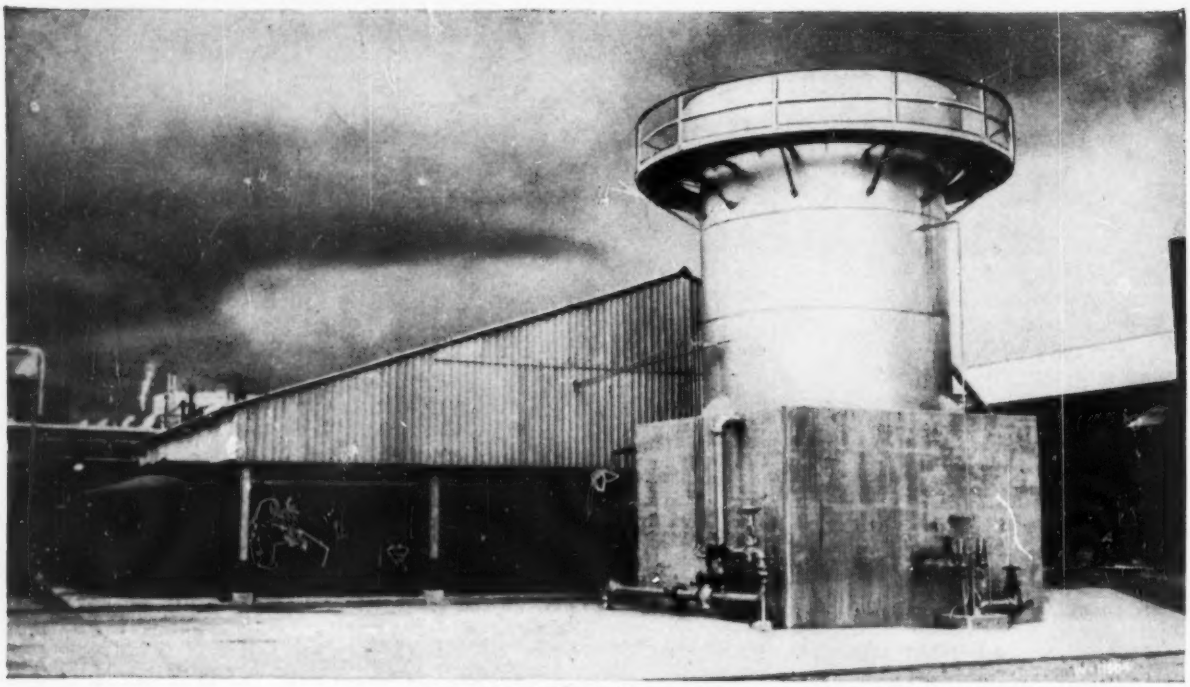
Greater Efficiency on Large, Constant-Speed Applications Can Lower Power Costs Substantially

On certain applications selection of General Electric synchronous motors can bring about substantial savings in plant operating costs. Synchronous motors usually have a higher full-load efficiency than any other type of motor, produce more work per dollar's worth of power consumed.

Furthermore, synchronous motors may be able to improve plant power factor—the ratio of total kilowatt load to total kva load. When these two fall out of balance, high system losses, high power bills, or increased maintenance costs commonly result. Using a *unity power factor* synchronous motor adds only to total kw load. And, a *leading power factor* synchronous motor will actually supply reactive kva's to your system, while operating at its normal rated output.

Before you select a drive for a large piece of equipment providing heavy and continuous service, be sure to investigate the economics of General Electric synchronous motors. Call in your G-E representative—he'll be glad to discuss your situation with you. Also, information on G-E synchronous motors and their application is available in the following bulletins: GEA-5332, "Low-Speed Synchronous Motors;" GEA-5426, "High-Speed Synchronous Motors;" GEA-5817, "Plant Power Factor Improved With G-E Synchronous Motors." Write to Section 770-27, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC



SPECIALLY DESIGNED 500 GPM WORTHINGTON TREATING SYSTEM at the new Pemex natural gas refinery in Poza Rica, Mexico. System includes cold-process slurry-type softener followed by acid feed, filtration and zeolite treatment. Engineered by Arthur G. McKee Company.

Specially Designed for Intermittent Service

Softening system for boiler feed water built for short-period operation, long shutdowns

Water conditioning requirements are especially tough at the new Pemex natural gas refinery in Poza Rica, Mexico.

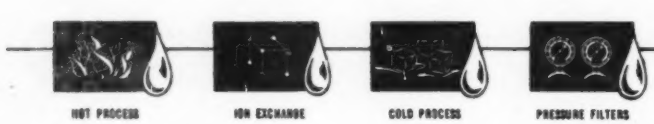
Their need for variable-rate, continuous-service softener operation is complicated by the intermittent boiler feed-water storage demands.

Pemex's conditioning requirements have been met by a specially built Worthington system, so designed that the slurry bed is not lost during "off-service" periods. The bed resumes its normal suspended position at the instant service is resumed. This avoids the irregular treatment, delay and water waste common in systems that require creation of a new slurry bed after each shutdown period.

New Bulletin W-212-B5 gives you the vital facts about this unique cold process water softening method. Write for your free copy today.

Worthington engineers and builds equipment for all the major types of water-conditioning systems, therefore is in an excellent position to give comprehensive and well-balanced recommendations on your water-conditioning equipment problems . . . further proof that *there's more worth in Worthington*. Worthington Corporation, Water Treating Section, Harrison, N. J.

J.1.3

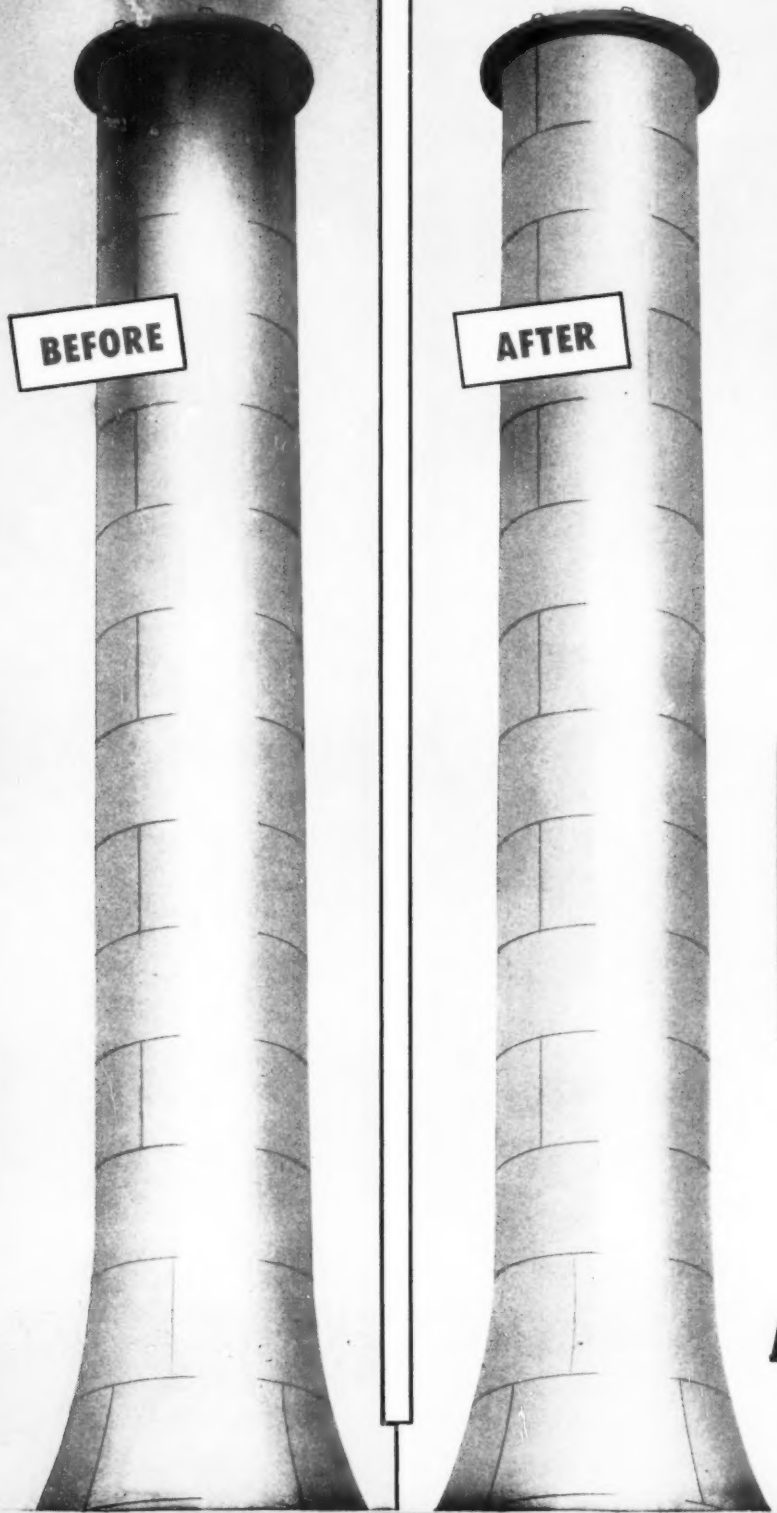


Worthington Makes More of the Equipment for ALL Types of Water Conditioning Systems

WORTHINGTON

Water Conditioning

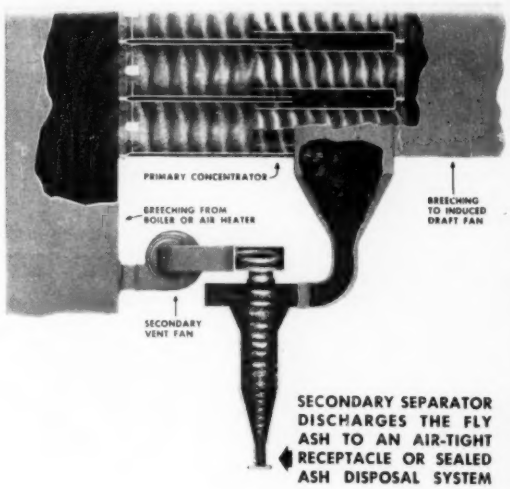
American Blower . . . a time-honored name in air handling



Installation of an American Blower Type ST Fly Ash Precipitator can make the difference shown here.

On a given application, as the load falls off and fly ash becomes harder to catch, the ST Precipitator automatically maintains a higher efficiency than any other collector of mechanical type.

Contact the American Blower or Canadian Sirocco Branch Office nearest you. They are conveniently located throughout the United States and Canada to provide complete information concerning the benefits of installing fly ash precipitators in your plant to meet your specific needs. Call on one today.



SECONDARY SEPARATOR DISCHARGES THE FLY ASH TO AN AIR-TIGHT RECEPTACLE OR SEALED ASH DISPOSAL SYSTEM

AMERICAN BLOWER

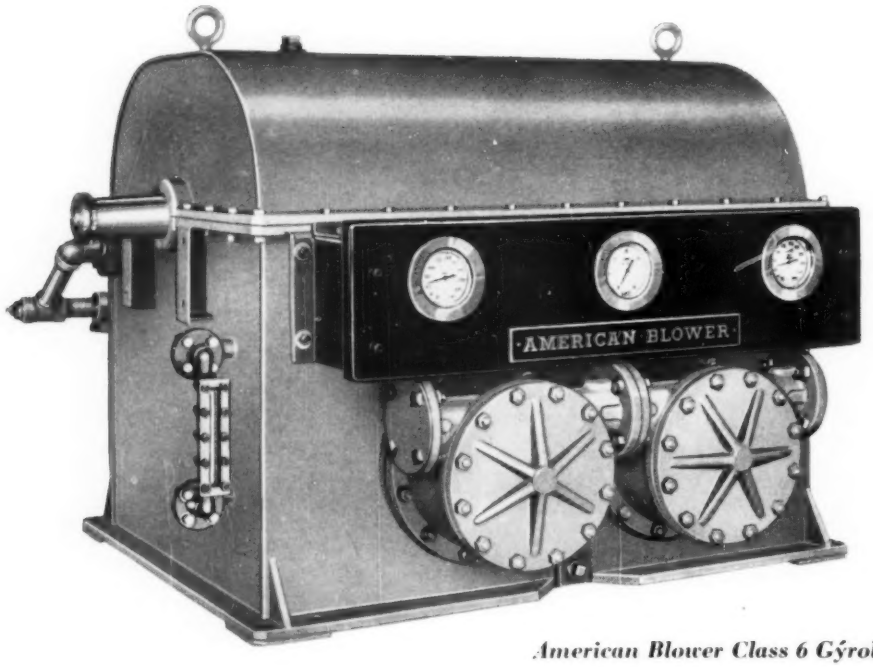
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS HEATER

American Blower . . . a time-honored name in power plant equipment



American Blower Class 6 Gýrol Fluid Drive

Memo to Power Plant Men —

You can enjoy important power savings, flexible stepless control, reduced maintenance, and get lower pressures at reduced flows for your boiler-feed-pump operation. Install an American Blower Adjustable Speed Gýrol Fluid Drive with a constant speed driving motor.

AMERICAN BLOWER

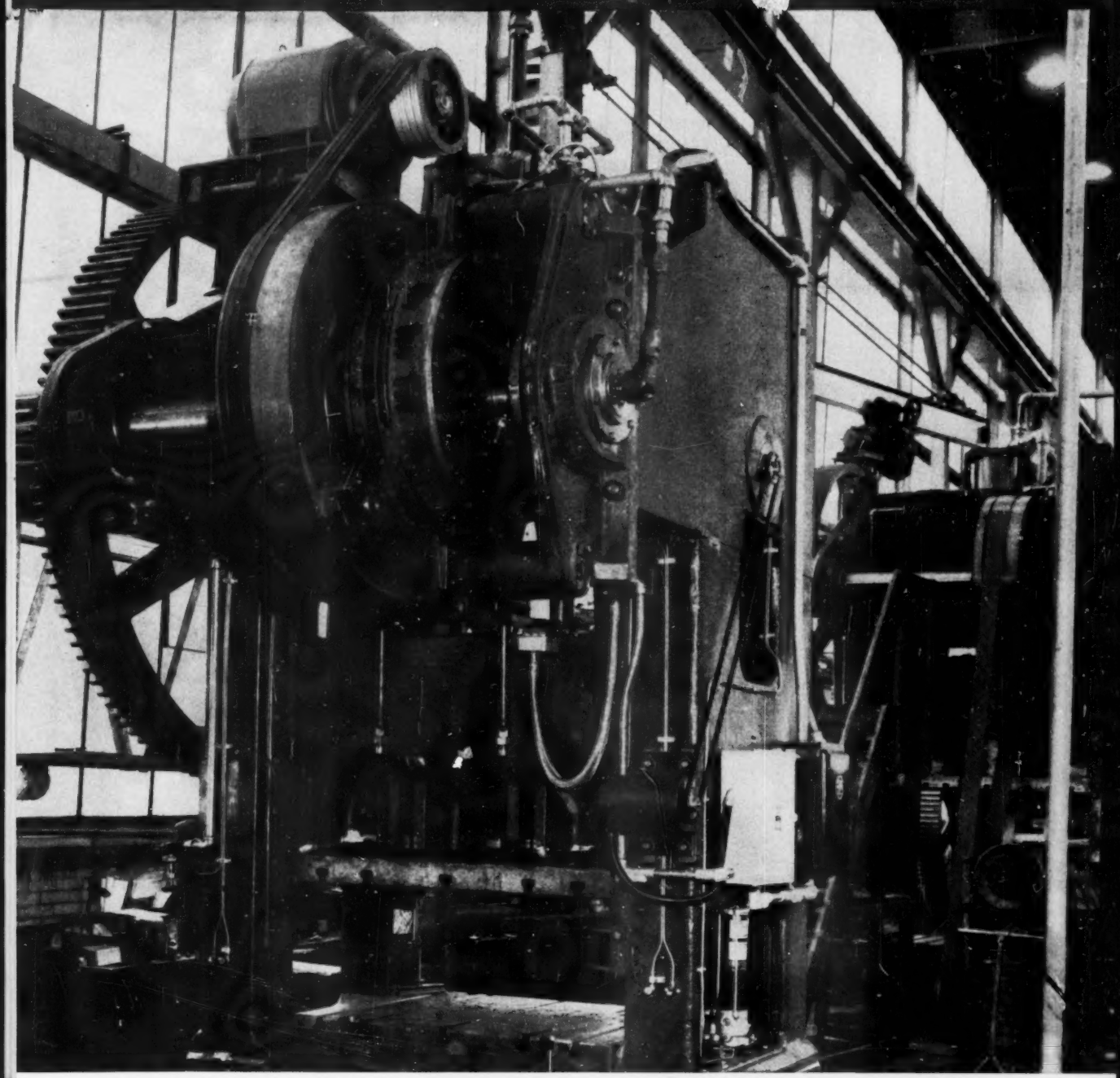
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS HEATER

B.F.Goodrich GROMMET BELTS AT WORK



Two hundred tons of force and iron are walloped down on unshaped metal to make a refrigerator door or hub cap for a car.

Iron fist with 200-ton punch

Metal things you see every day take shape on a giant press like this. The four rubber V belts at the top give the press its punch. But when they ran at full speed, shocks from the press made ordinary V belts go to pieces, in a few days. Then part of the press had to be taken apart to install new belts. It took an entirely different kind of belt to solve this problem—as shown on the following pages.

200-ton punch (continued)

Repeated wallops—sometimes 15 punches a minute—caused frequent knockouts to ordinary belts on E. W. Bliss Co. presses.

To solve the problem described on the preceding page, the press maker called in B. F. Goodrich men. What about the grommet V belt? It had been developed by B. F. Goodrich to give belt users more wear for their money. Could grommet belts stand the shocks on the big presses? They began using this different kind of V belt and found it not only took the punishment longer but did a better job of running the press too. Here's why:

20 to 50% Longer Life

Patented grommet V belts by B. F. Goodrich represent the only basic improvement since invention of the V

belt. Belts last 20 to 50% longer, depending on service. (The more severe the service the greater the increase over ordinary belts.)

What is a grommet?

A grommet is like a giant cable except that it's endless—a cord loop built up by winding heavy cord on itself. There is no overlapping cord *section* as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

All Cords Put to Work

Each grommet and every part of a grommet carries its share of the load. In ordinary belts under high tension the center cords "dish" because tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Grommet V belts have no center cords, there is no dishing—therefore much more strength in proportion to cord volume.

Better Grip, Less Slip

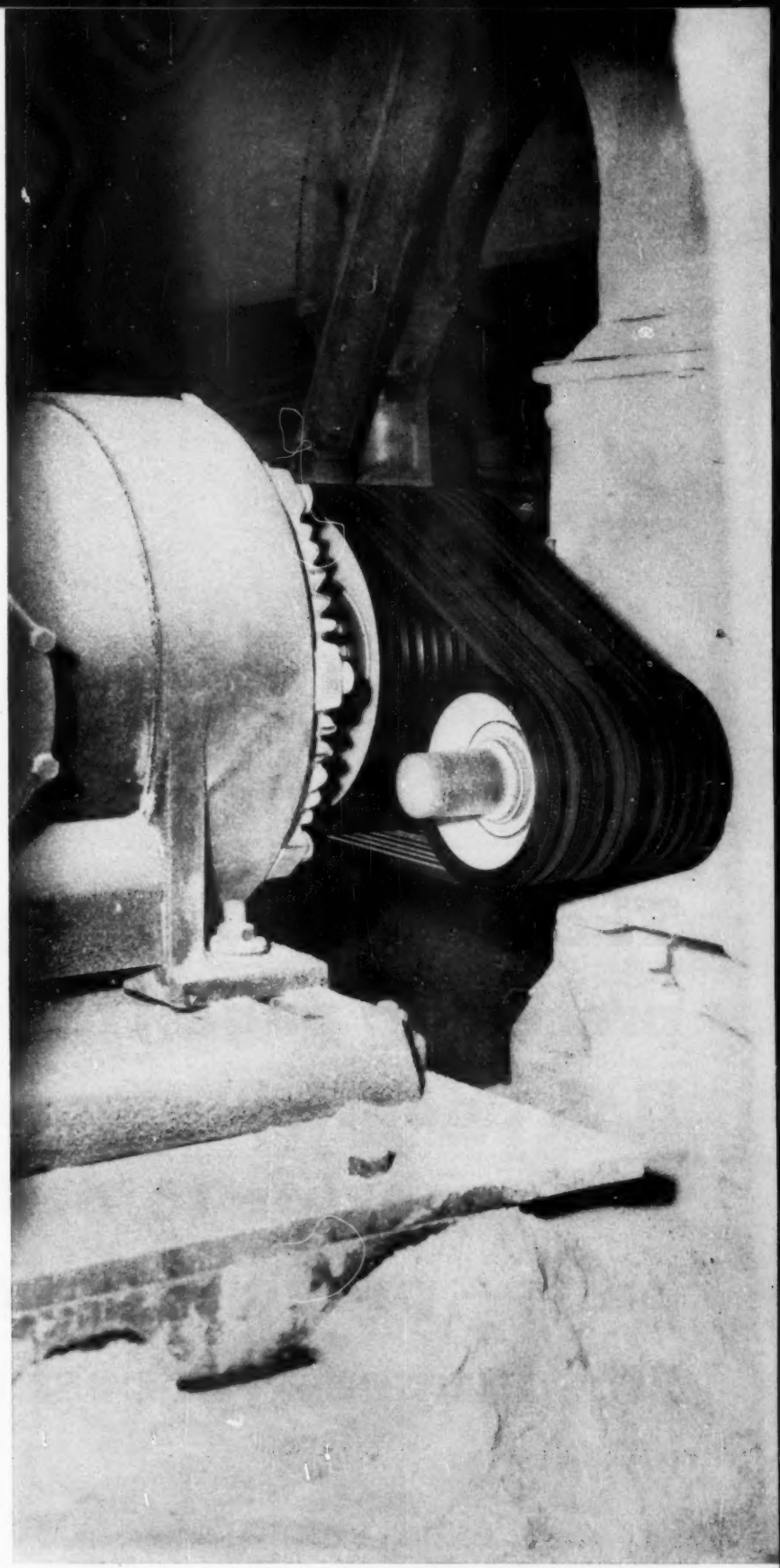
Grommet V belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip there is also less surface wear.

They Cost No More

You save belt costs because belts last longer, save production costs because machines keep running with fewer interruptions, save maintenance costs because they need less attention, yet cost not one cent more than others. Grommet belts are made in C, D and E sections. They are patented by B. F. Goodrich. No other V belt is a grommet belt (U. S. Patent No. 2,233,294).

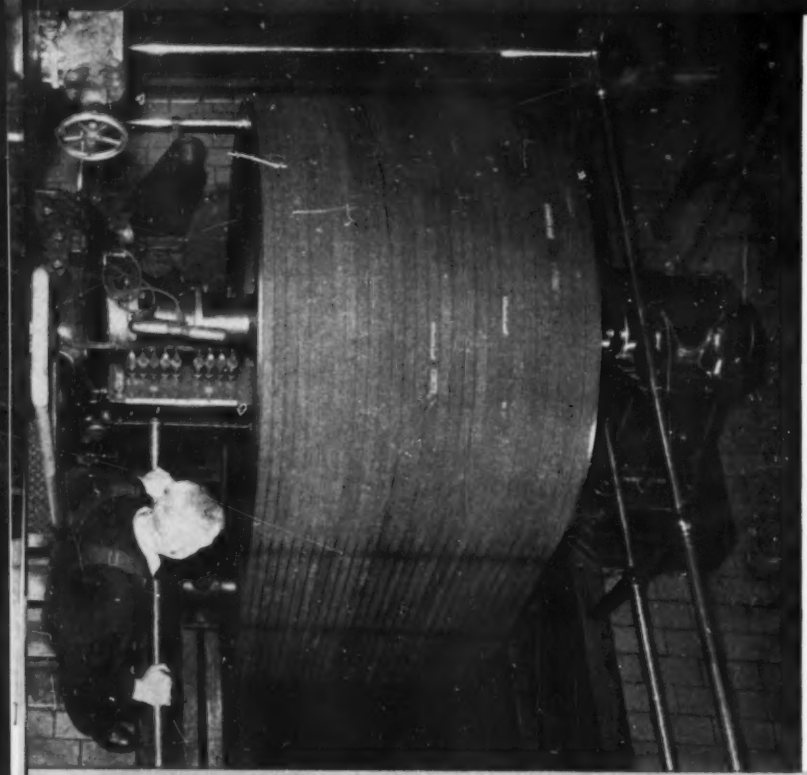
Tough grind

Those belts run a hammermill that grinds grain into feed products. Ordinary belts, previously used, couldn't stand the heavy load, couldn't take the strain of 24-hour-a-day service. There were frequent shutdowns for repairs, and the belts were averaging only 3 months' service. Then a B. F. Goodrich distributor studied the drive, and suggested installing a set of grommet V belts. In spite of running night and day, the B. F. Goodrich grommet belts have already outlasted the ordinary belts 3 to 1, and are still at work.



Belt service was tripled, maintenance costs were cut nearly 100%.

B.F.Goodrich GROMMET BELTS AT WORK



Cooling off period

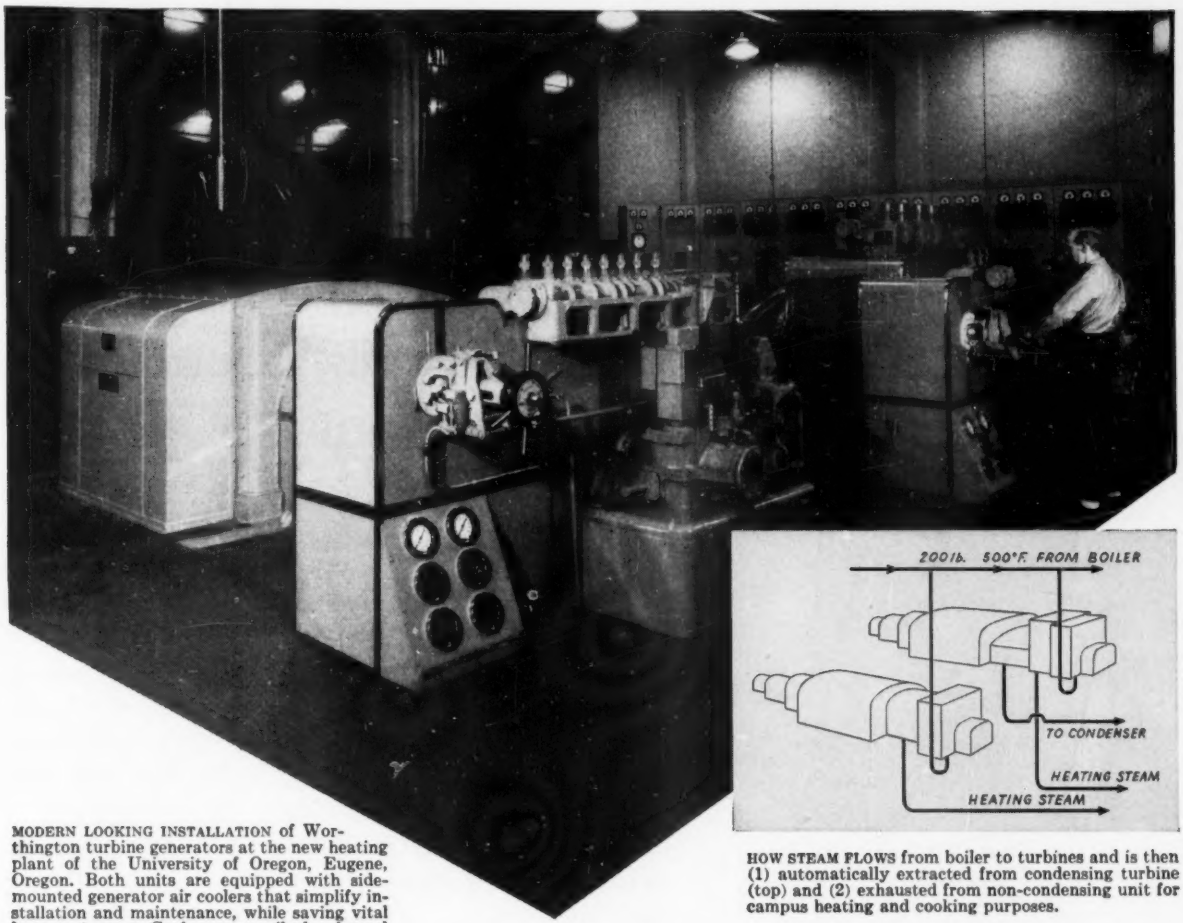
Before beer is bottled and sold, it's aged in huge vats. The temperature must be held near freezing—constantly. In addition to running night and day, the belts used to run the cooling equipment are exposed to heat from the basement. A BFG representative studied the drive, and said grommet V belts could handle the job. A set was installed and lasted a record-breaking 14 years. One reason why BFG grommet V belts last 20 to 50% longer is that they stay cooler by generating less internal heat than ordinary belts, and are made of rubber that stands boiling temperatures.

← *Belts that keep cool, keep beer cold at Jacob Ruppert Brewery, New York.*

These typical examples (see preceding pages) tell you why B. F. Goodrich grommet belts are superior to ordinary V belts — prove they last 20 to 50% longer—yet cost no more.

Grommet V Belts BY
B.F.Goodrich
FIRST IN RUBBER

The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio



MODERN LOOKING INSTALLATION of Worthington turbine generators at the new heating plant of the University of Oregon, Eugene, Oregon. Both units are equipped with side-mounted generator air coolers that simplify installation and maintenance, while saving vital basement space. Coolers can easily be cleaned during turbine operation.

HOW STEAM FLOWS from boiler to turbines and is then (1) automatically extracted from condensing turbine (top) and (2) exhausted from non-condensing unit for campus heating and cooking purposes.

Worthington turbine generators at U. of Oregon designed for operating flexibility and appearance

When the University of Oregon built the new heating plant in 1951, the plans included installation of two turbine generators which would supply all the school's present and anticipated electrical and steam requirements.

But the university had another requirement—one not uncommon these days—that the installation be as clean and as modern looking as possible. One look at the above photograph and flow diagram shows that they got both in the Worthington turbine generators now in operation at the plant.

In the installation of Worthington turbine generators, the University of Oregon was assured of low-cost power and steam. It was also assured of the undivided responsibility that goes with turbine generators, designed, engineered, assembled and tested as complete units before shipment.

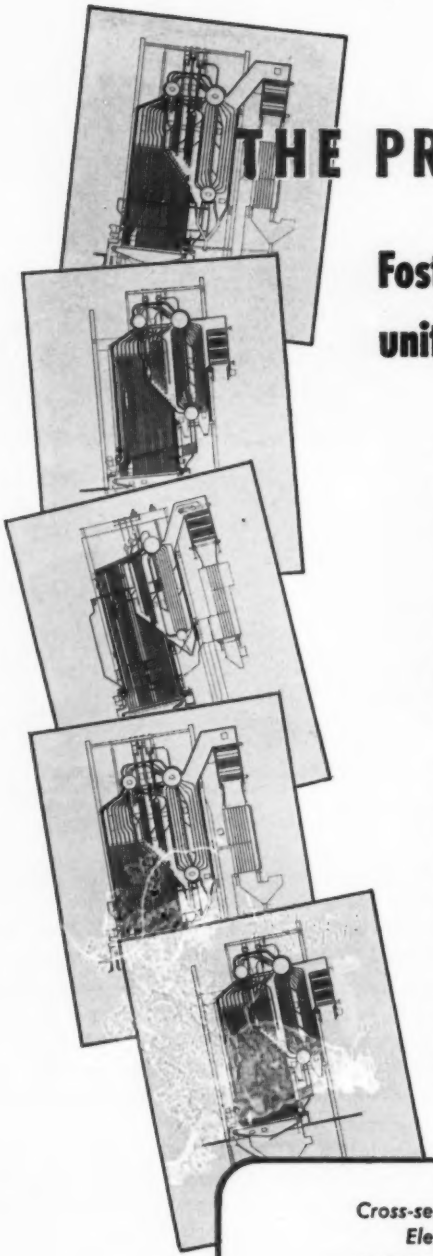
Sizes to 10,000 kw. Worthington Corporation, Steam Turbine Division, Wellsville, New York.

T-2-18

A GREAT TEAM IN STEAM

WORTHINGTON

Steam Turbine Generators



THE PROOF OF SATISFACTION

Foster Wheeler installs 18 spreader-stoker units for six customers!

The surest proof of customer satisfaction for any product is a repeat order. And on major equipment, such as steam generators, customer acceptance means satisfaction from planning through actual operation.

That's why Foster Wheeler is proud of this record of repeat installations of versatile spreader-stoker-fired units with their capability of burning a wide variety of bituminous coals. Installations up to 325,000 lbs per hour have been made for:

CENTRAL ILLINOIS ELECTRIC and GAS CO.	5 UNITS
CENTRAL IOWA POWER COOPERATIVE	2 UNITS
MONSANTO CHEMICAL CO.	4 UNITS
NORTHERN STATES POWER CO.	2 UNITS
STUDEBAKER CORPORATION	3 UNITS
WEST VIRGINIA PULP and PAPER CO.	2 UNITS

These installations are another example of Foster Wheeler's ability to design, engineer, fabricate and construct power-producing equipment to meet your needs.

Cross-section of latest stoker-fired steam generator designed for Central Illinois Electric and Gas Co., Sabrooke Generating Station, Rockford, Illinois.

CAPACITY	300,000 lb per hr
PRESSURE	950 psig
FINAL STEAM TEMPERATURE	875 F
FEED TEMPERATURE	350 F

FOSTER WHEELER CORPORATION, 165 BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER

...REPEAT ORDERS!

Select an

ALLIS-CHALMERS

Rocking Contact

VOLTAGE REGULATOR

For ANY Size GENERATOR!

Send for More Information!

Rocking Contact Voltage Regulators and *Regulex* Rotating Regulators are described more fully in bulletins and leaflets. Indicate those you'd like to have and give the coupon to your A-C representative, or send it to Allis-Chalmers, Milwaukee 1, Wis.

ALLIS-CHALMERS,
Milwaukee 1, Wisconsin

Send me the leaflets and bulletins checked below:

- ☐ V-00 and 221 Regulators for small ac machines 14B6143A
- ☐ Regulators for medium size ac machines 14B6035
- ☐ Regulators for large ac machines 14B6015
- ☐ Regulators for dc machines 14B6137
- ☐ *Regulex* Rotating Regulators

Name ..... Title .....

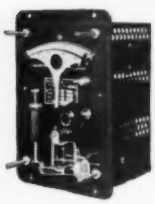
Company .....

Address .....

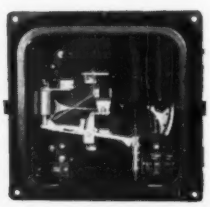
City ..... State A-3582

dc REGULATORS

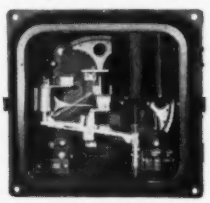
VD-00 Regulator for dc generators from 1 kw at 360 rpm to 75 kw at 3600 rpm. Front view, cover on.



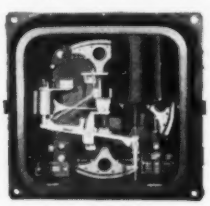
VD-221 Regulator for dc generators from 1 kw at 164 rpm to 400 kw at 3600 rpm. Note *Rocking Contact* sector.



VD-2 Regulator for dc generators from 10 kw at 80 rpm to 2000 kw at 3600 rpm.

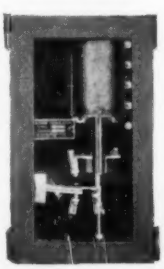


VD-3 Regulator for dc generators from 50 kw at 80 rpm to 7500 kw at 1200 rpm.

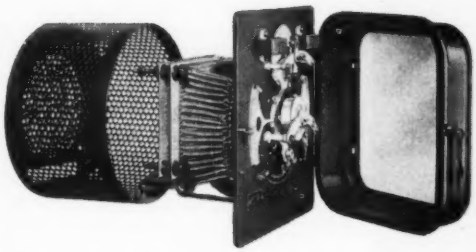


VD-4 Regulator is used on large dc machines. Note the four *Rocking Contact* sectors.

YD Regulator is used to control large dc machines requiring the use of a motor-operated rheostat. The control element is designed for panel mounting.



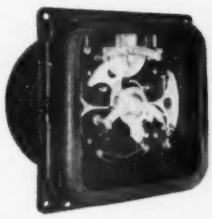
ac REGULATORS



All Allis-Chalmers mechanical regulators have *Rocking Contact* sectors sealed in the dust-tight front portion of the regulator housing. The smooth-working, carbon graphite sector face rocks on a curved silver-surfaced commutator . . . regulates with slight movement—reduces wear.

Ventilated rear section contains wire-wound resistance elements, each accurately designed according to the characteristics of your generating equipment and connected to a segment of the commutator.

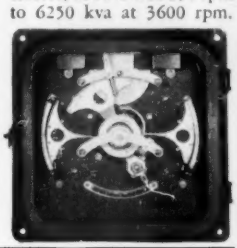
For Medium Size Generators



Type A Regulator for ac generators, 125 kva at 257 rpm to 1750 kva at 3600 rpm.

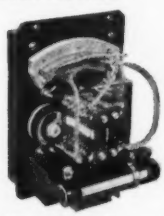
Type B Regulator for ac generators, 1000 kva at 257 rpm to 6250 kva at 3600 rpm.

Type C Regulator for ac generators from 3125 kva at 257 rpm to 25,000 kva at 3600 rpm. A, B, and C regulators have a guaranteed sensitivity of plus or minus 0.5 percent.

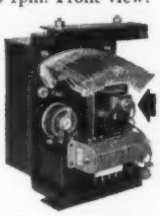


For Small Generators

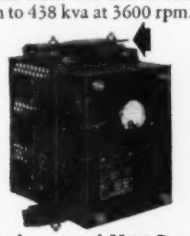
V-00 Regulator for ac generators up to 157 kva at 3600 rpm. Front view.



221 Regulator for ac machines from 188 kva at 720 rpm to 438 kva at 3600 rpm.

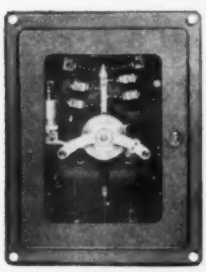


385 Regulator is temperature compensated for temperatures from 40 F to 150 F.

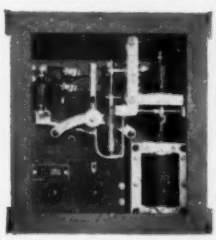


Shock-mounted V-00 Regulator for applications where vibration is a factor.

For Large Generators



Type J Element



Type JC Element

Type J Regulators consist of two parts: (1) a panel-mounting control element, and (2) a motor-operated rheostat.

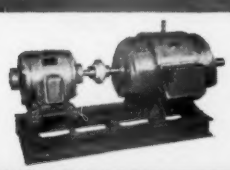
Type J is an indirect-acting regulator for larger generator installations requiring pilot exciters.

Type JC Regulators are specifically designed for Synchronous Condenser applications.

Motor-Operated Rheostat

ROTATING REGULATOR

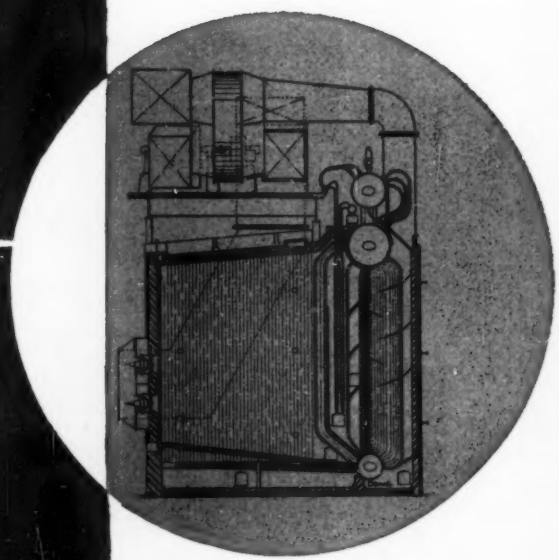
The *Regulex* Rotating Regulator is used on large machines. It consists of two parts: (1) a motor-generator set and (2) a control cubicle containing the static regulator elements. The *Regulex* exciter is similar to a dc generator in construction.



Regulex and Rocking Contact are Allis-Chalmers trademarks.

ALLIS-CHALMERS

one VU



1. VU-50 Unit, installed in a Petroleum Refinery. Burning natural gas and oil, the unit has a capacity of 260,000 lb of steam per hr at an operating pressure of 400 psi and steam temperature of 660 F.

GINEERING

SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

It seems that the story *never ends* with the purchase of the first Vertical-Unit Boiler. Company after company has installed a VU unit . . . liked it . . . and then bought another — and another — and often another. This is true in every branch of industry, but the three typical examples described below and illustrated by the accompanying drawings will serve to illustrate the point.

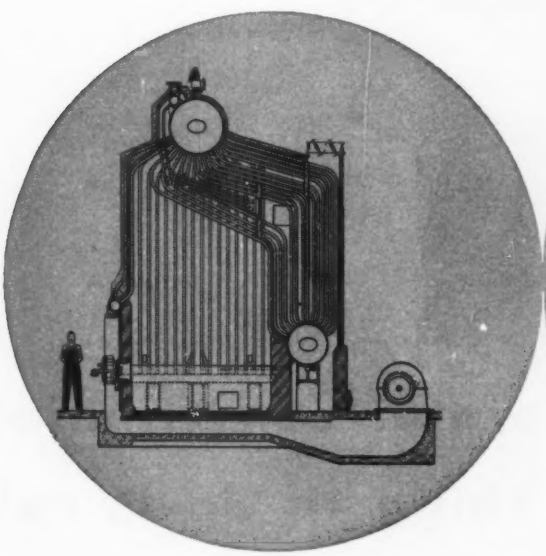
A Petroleum Refinery (1) ordered its first Vertical-Unit Boiler in 1937. A second VU Unit was installed in 1941, and a third in 1950. For another of its plants, two VU Units were ordered in 1942; a third, in 1947.

An Automobile Company (2) installed its first two VU Units in 1947. Two more were ordered for another of its plants in 1948; then three more units for a third plant in 1949 and two more for still another plant in 1950.

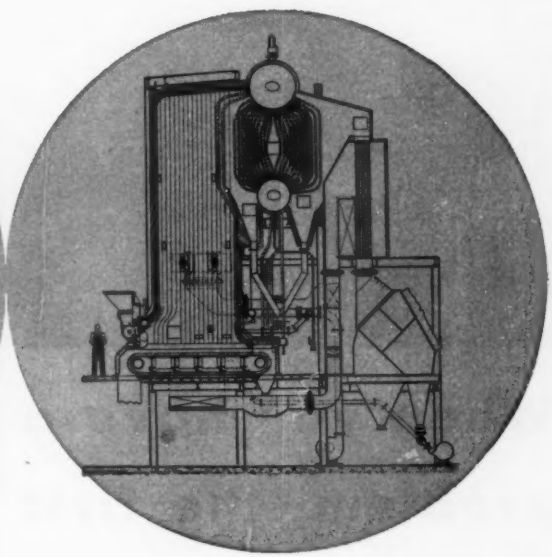
A Chemical Company (3) ordered two VU Boilers in 1939. In 1946, five more were ordered for three of their other plants. In 1949, two more were ordered for one of these same plants, and in 1950 two more units for a fifth plant. In 1951, seven more VU Units were ordered for still another plant — eighteen units for six plants in twelve years!

• • •

And so it goes — in all sections of the country — companies representing every type of industry . . . paper, food, mining and metal working, brewing, rayon, aircraft — and many others in addition to the examples pictured here . . . ordering and reordering VU Boilers. There must be a reason — and there is. It's lower steam costs and top reliability. These companies have found *through experience* what they can expect in economy and performance when they buy VU Boilers.



2. VU-10 Unit, one of three duplicates installed in an automobile plant. It is fired with oil or gas. VU-10 Boilers range in capacity from 10,000 to 60,000 lb of steam per hr. They may also be fired by spreader, underfeed or traveling grate stokers.



3. VU-40 Unit, one of seven, now being installed in a Chemical Plant. These boilers will be fired with C-E Spreader Stokers (continuous discharge type). The capacity of each is 60,000 lb of steam per hr at an operating pressure of 325 psi; no superheat.

B-639

— SUPERHEATER, INC.

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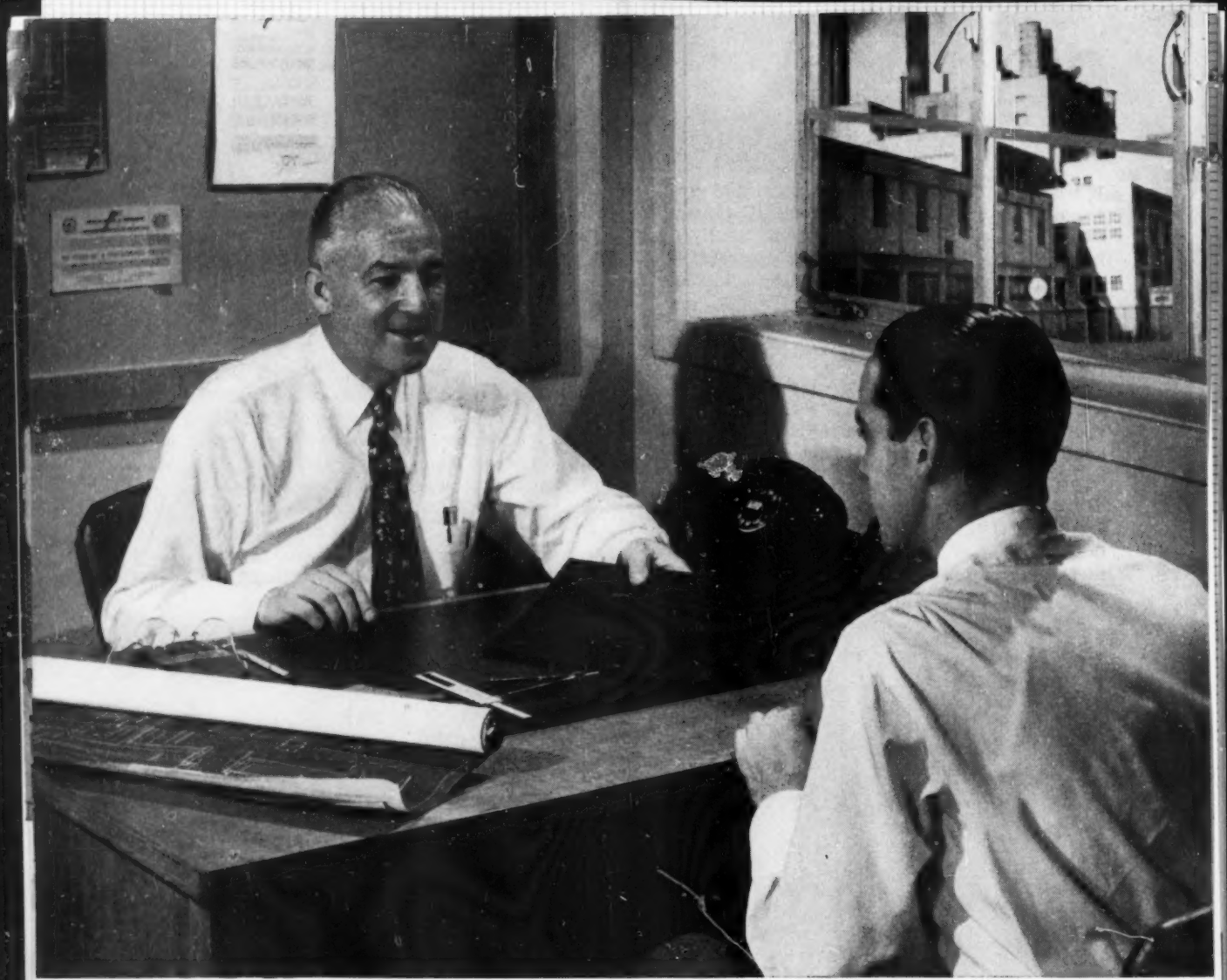
C-E



When you have a water conditioning problem—the first thing to do is call

cochrane

Whether your requirements are large or small, call a Cochrane Water Engineer. Supported by his recommendation, you'll be sure you're right.

. . . water conditioning is a problem for specialists. The Cochrane people specialize in water engineering and water conditioning equipment. And since Cochrane manufactures all types of water treating equipment their recommendations are unbiased. Cochrane engineers will show you how to obtain most economically the quality of water you want. Call Cochrane first when you have a water conditioning problem.

THERE'S A COCHRANE SOFTENING PROCESS TO GIVE YOU THE WATER YOU WANT

When you have a water softening problem—Cochrane Water Engineers can give you the right answer. Through many years of experience in all types of water treatment—including ion exchange—Cochrane offers five distinct processes, each with specific advantages for a particular job:

Hot Zeolite Process
Sodium Zeolite
Hydrogen Zeolite
Dealkalization
Demineralization

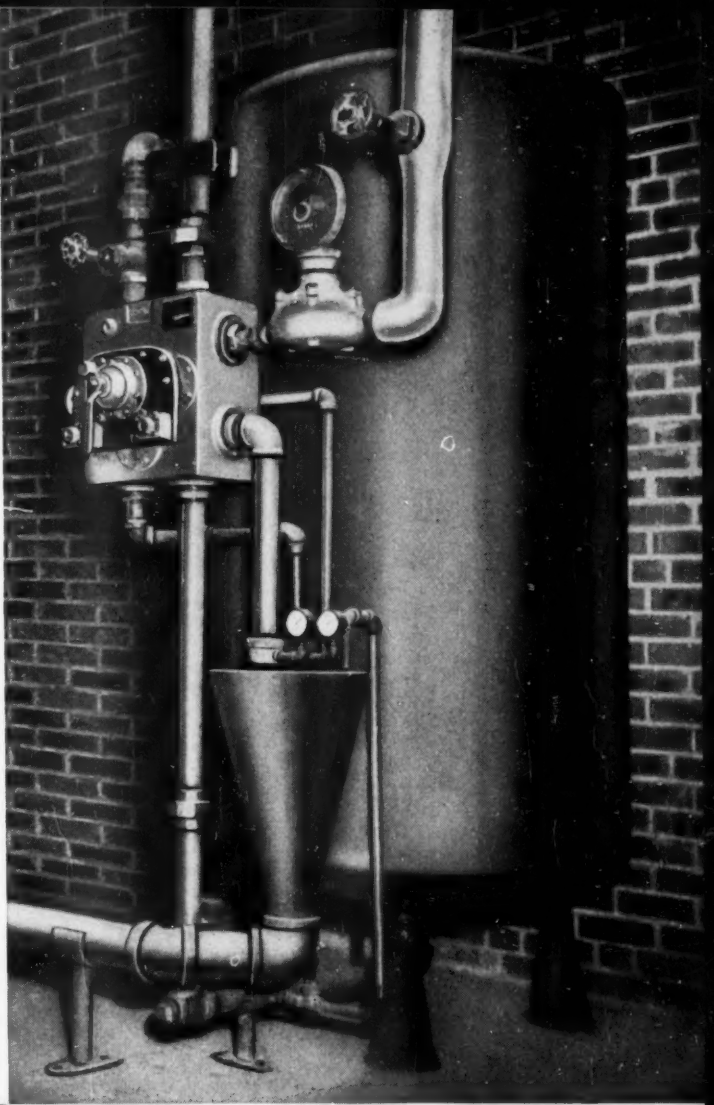
A Cochrane Water Engineer will be glad to explain the differences in these processes. He'll show you how the one process best suited to your requirements will provide water of the quality you want, cheaply and abundantly—from any raw water.

COMPLETE DEAERATION OF BOILER FEEDWATER

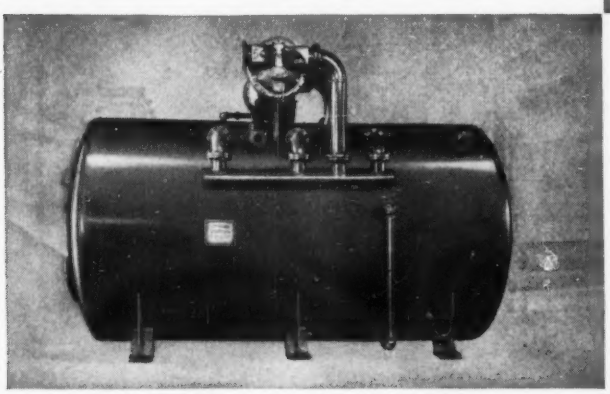
Cochrane provides all types of Deaerators to meet any requirements:

Tray-Type Deaerators
Atomizing Deaerators
Deaerating Hot Water Generators
Cold Water Deaerators

One of these units can be applied to your particular boiler feedwater requirements and built of materials suited to your service. A Cochrane Water Engineer will bring you the benefit of Cochrane's long experience in conditioning boiler feedwater.



Cochrane Zeolite Softener installed with a HYDROMATIC Single Control Valve.



Cochrane Tray-Type Deaerator for Central Station installation in the Southwest.

Cochrane equipment covers the full range of water conditioning:

HOT PROCESS SOFTENERS
HOT AND COLD ZEOLITE SOFTENERS
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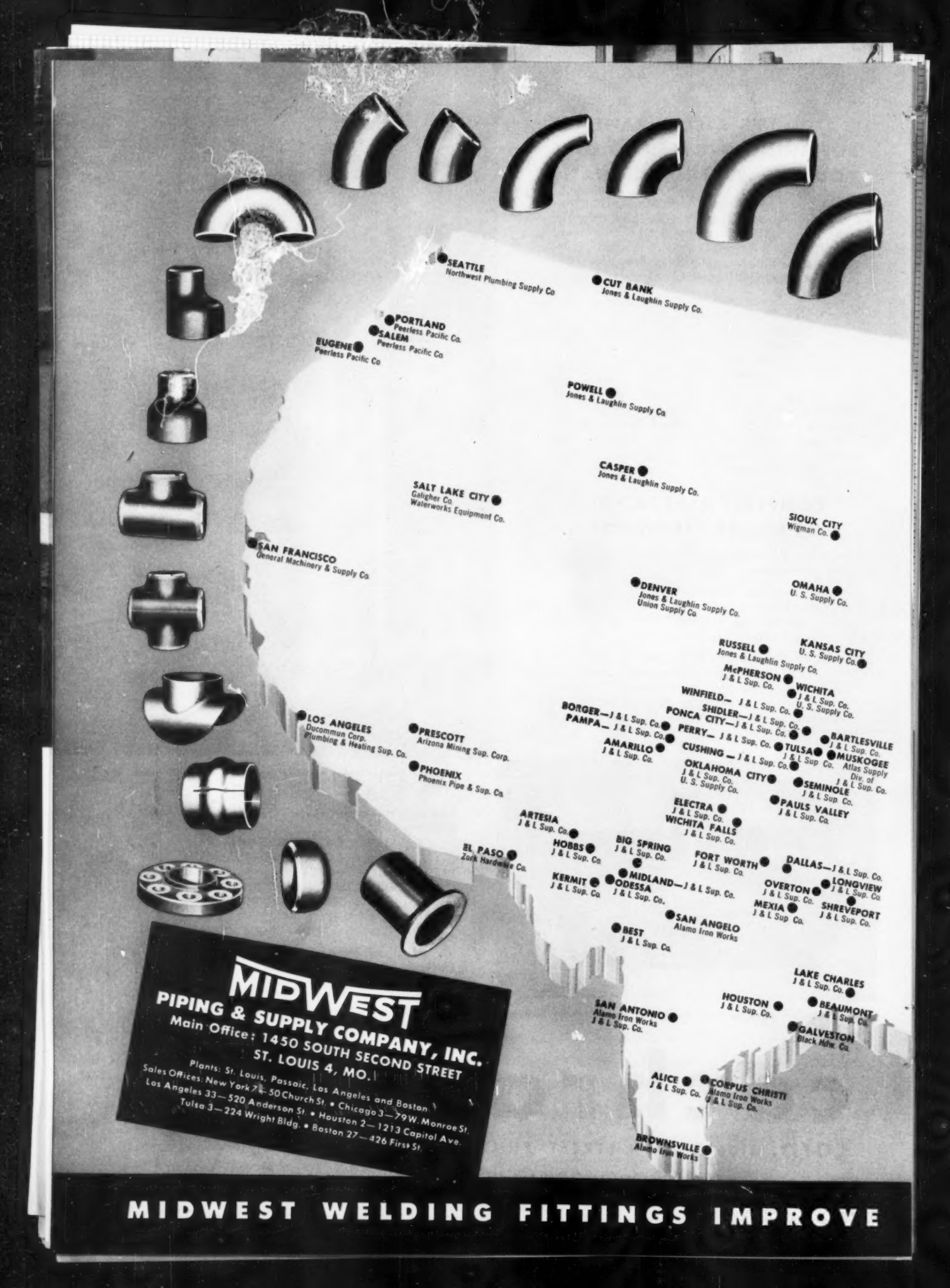
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Ask an Allis-Chalmers engineer about transfer bus arrangements and what they can mean to your plant in savings and service. Call your nearby Allis-Chalmers district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

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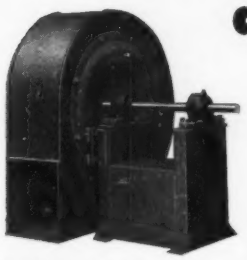
The Sign of Resourceful Engineering and Economical Performance



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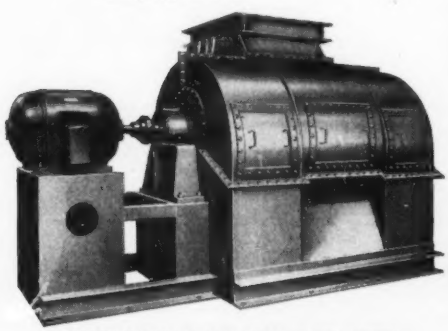

MECHANICAL DRAFT FANS—both forced and induced draft. Heavy-duty construction for continuous operation at peak loads.

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It's nearly 40 years since we started building fans, blowers and allied products. We have had ample time to temper research with experience, engineering with sound practice, manufacturing to actual operating in-the-field demands . . . .

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Ordeal by SUPERHEATED STEAM *Up to 1300F 5000 psi. for Edward Valves*

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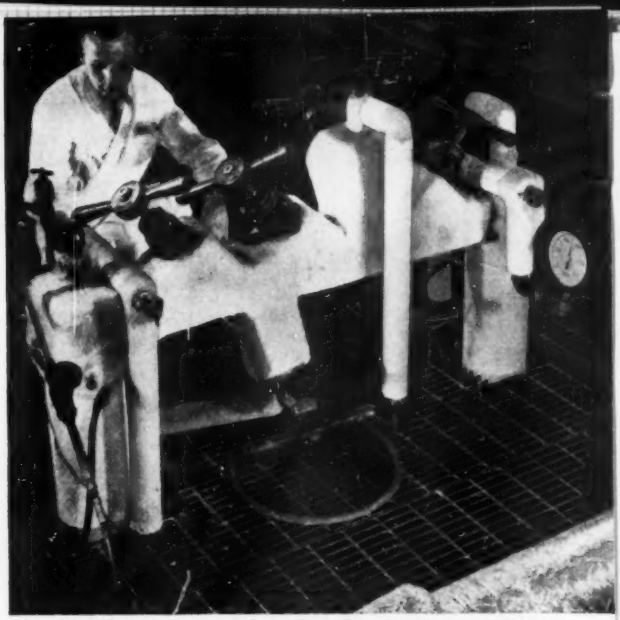
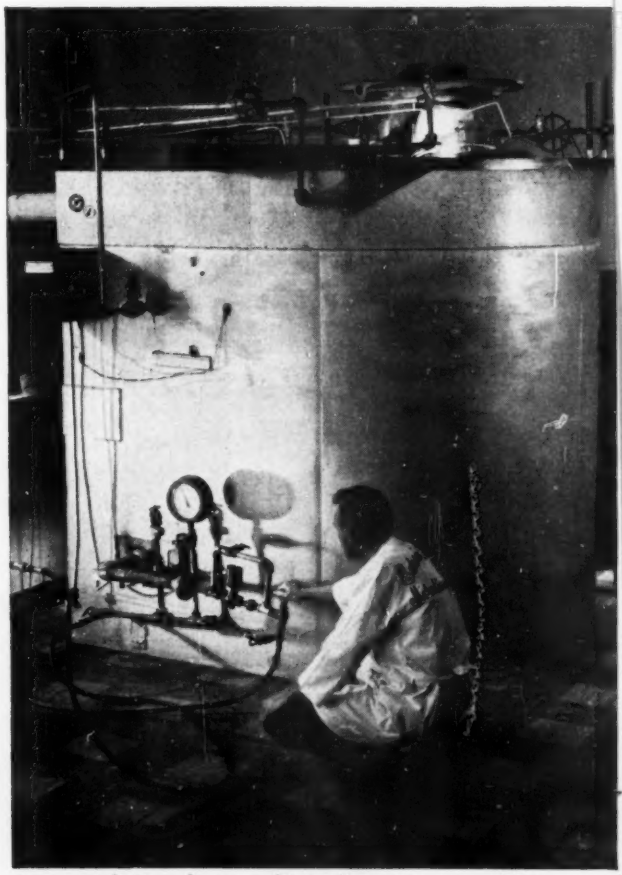
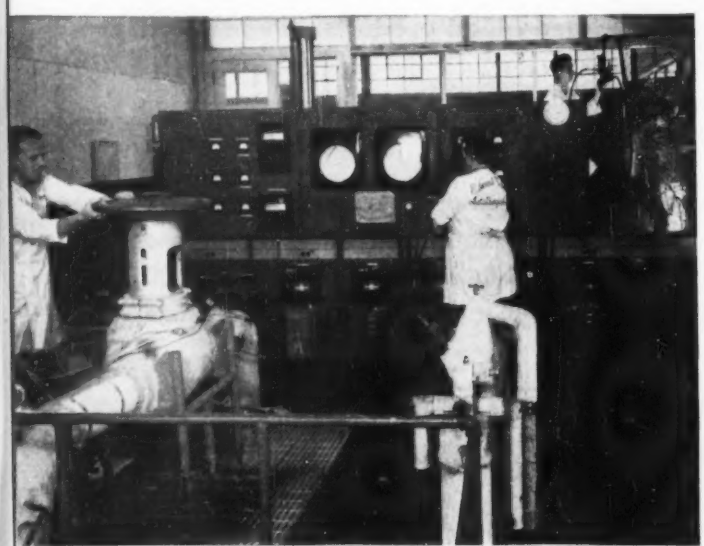
Development of this outstanding new research tool demonstrates Edward's constant search to improve its products—to more than meet the continual challenge posed by constantly increasing temperatures and pressures. For these reasons, Edward maintains the largest laboratories in the world devoted exclusively to research on steel valves. You can continue to expect the best from Edward.



Edward Univalves in test on superheater loop. Flow through center valve is alternated between superheated steam in main loop and high pressure water in and out of tee connection.



Gas operated pit-type furnace used to supplement tests on superheater loops. With this equipment, valve bodies are tested at temperatures up to 1500 F, pressure up to 5000 psi.



Two superheater test loops in Edward Laboratories. Technician at left is testing operation of 6 in., 2500 lb globe valve rated for 1033F, 2500 psi. which is under a thousand hour test at 3500 psi. and 1100 F with flow of 5000 lbs of steam per hour.

Edward Valves, Inc. Another Product

Write for 16 page bulletin giving complete information on tests with revolutionary new superheater loop equipment.

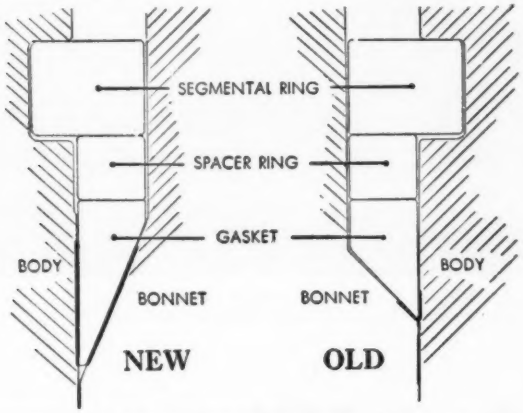
NEW IMPROVED *PRESSURE-SEAL*® DESIGN BY EDWARD

Edward, first to use pressure-sealed construction on non-return valves, has been experimenting for 8 years in an effort to improve on the original PRESSURE-SEAL design.

Final fruit of this research is the new design shown in the diagrams below. Biggest innovation in the new construction is a change in the bonnet-gasket angle from 45 degrees to 25 degrees. Other changes include a recess in the body bore above the gasket area, and a new coating applied to the gasket material.

New design advantages include:

1. THREE TIMES AS MUCH SEALING AREA. The sealing area between body and gasket is now three times greater than with the old construction. This eliminates the possibility of small leaks through minute imperfections sometimes possible with the conventional pressure-sealed construction.



2. TWICE AS MUCH SEALING PRESSURE. The new angular relationship of the bonnet and gasket gives a sealing force twice as great against the gasket for the same line load.
3. SEAL-COATING. A special coating one-thousandth of an inch in thickness is applied to the gasket. When pressure is applied to the gasket, this malleable coating is forced into tool marks and minute imperfections to give a perfect seal.
4. IMPROVED BODY SEALING SURFACE. Special preparation of the vital body-gasket sealing zone insures pressure tightness in this area.
5. EASY DISASSEMBLY. The diameter of the body bore has been enlarged just above the gasket area, facilitating disassembly and eliminating the necessity of pulling the gasket across a corroded area upon disassembly.
6. ELIMINATES GASKET DAMAGE. The cross section of the gasket has been blunted, eliminating a source of damage to the gasket during handling or storage.

Pressure-sealed construction has long been accepted as the most satisfactory for high temperature, high pressure service. These new improvements on the conventional design now available in Edward PRESSURE-SEAL Valves further establish this construction as the obvious choice for more demanding services.

EDWARD VALVES, Inc., *Subsidiary of*
ROCKWELL MANUFACTURING COMPANY
1220 W. 144th STREET • EAST CHICAGO, INDIANA

GLOBE AND ANGLE STOP • FEED-LINE • BLOW-OFF • NON-RETURN CHECK • GATE • GAGE AND INSTRUMENT • RELIEF • STRAINERS

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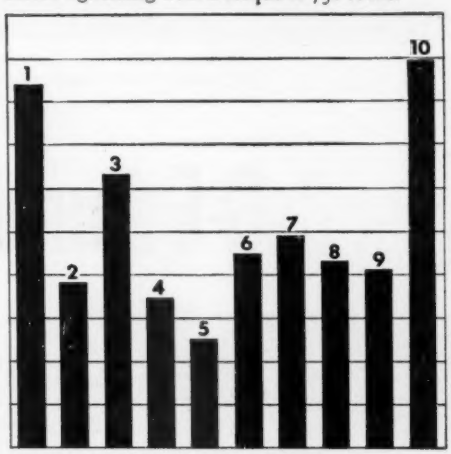
Technical Tips

High Temperature Lubricants For Valve Studs and Bushings

As temperatures increase, the problem of wear and galling between two metal surfaces also increases. Through the years a number of high temperature lubricants have been marketed to solve this problem. Most of these lubricants consist of a solid lubricant in some type of carrier which may or may not be of a lubricating nature itself.

A few years ago another new solid lubricant, molybdenum disulfide, began receiving a great amount of attention. Molybdenum disulfide has a laminar construction in which a plate of sulfur atoms is found on each side of a plate of molybdenum atoms. Molybdenum disulfide will cling tenaciously to a metal surface because of a strong metal to sulfur bond. It will slip easily against other molybdenum disulfide molecules because of the weakness of the sulfur to sulfur bond.

The chart shows the torque necessary to loosen a number of 1¼"x7" stud-nut assemblies after 5000 hours at 1000 F in a test conducted in the Edward laboratories. The stud-nut assemblies were lubricated thoroughly with various lubricants before tightening with a torque of 750 ft-lbs.



TORQUE TO LOOSEN STUD-NUT ASSEMBLY

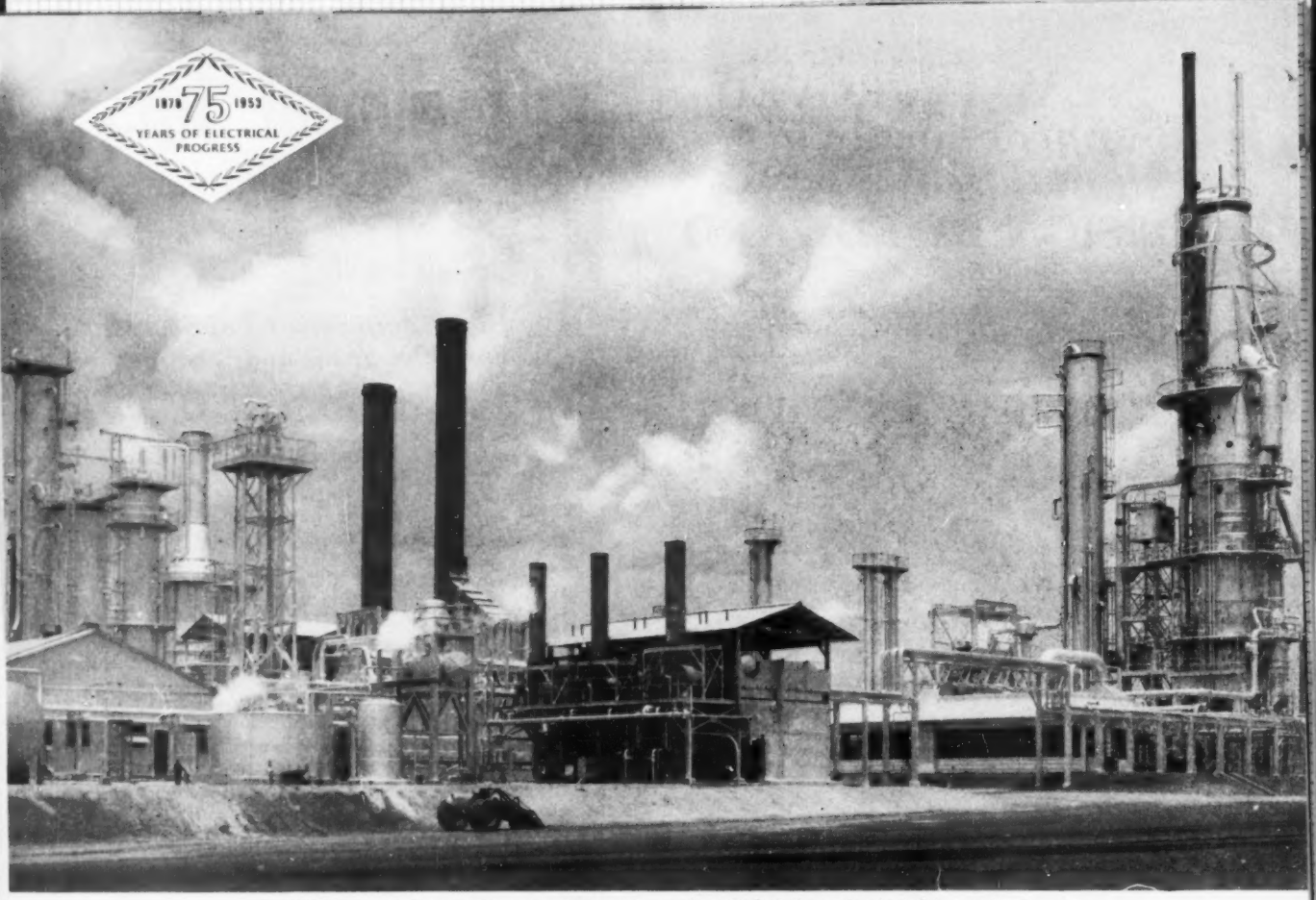
1. No Lubricant
2. Graphite Powder
3. Colloidal Lead
4. Colloidal Copper
5. Molybdenum Disulfide
6. Aluminum Powder
7. Lime-Calcium Base Grease
8. Silicone Grease
9. Colloidal Zinc
10. Colloidal Graphite

These test results show molybdenum disulfide to be a superior stud-nut lubricant. This same superiority is also true for bushing applications. It reduces the coefficient of friction to the lowest values ever obtained on a test in the Edward laboratories and substantially increases operating life.

Edward does not manufacture molybdenum disulfide lubricants. Names of suppliers will, however, be furnished on request.

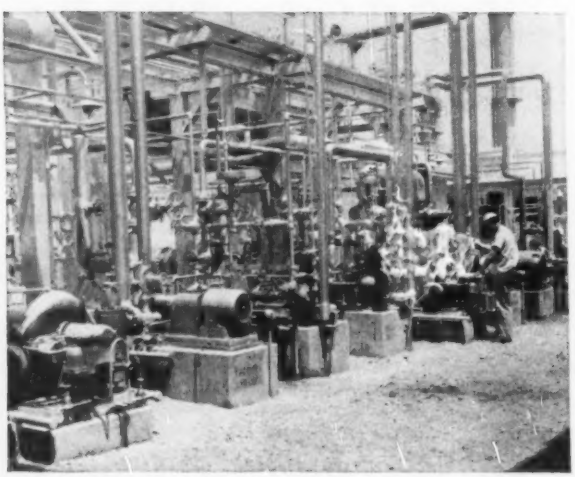
Edward

1878 75 1953
YEARS OF ELECTRICAL PROGRESS

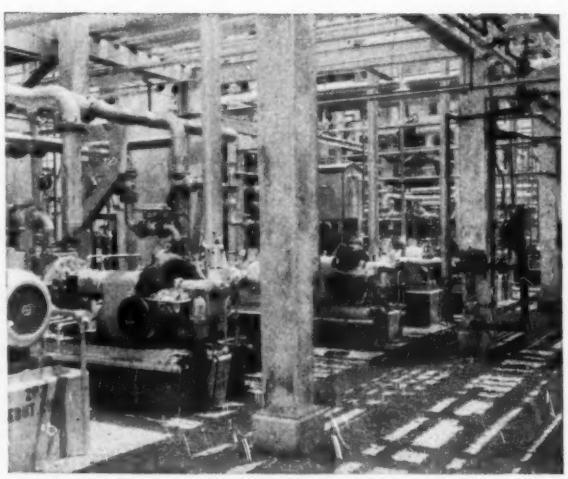


McMurrey Refining Company, Tyler, Texas, installed G-E mechanical-drive turbines throughout their plant to help assure continuous capacity output of 5000 bbls. per day.

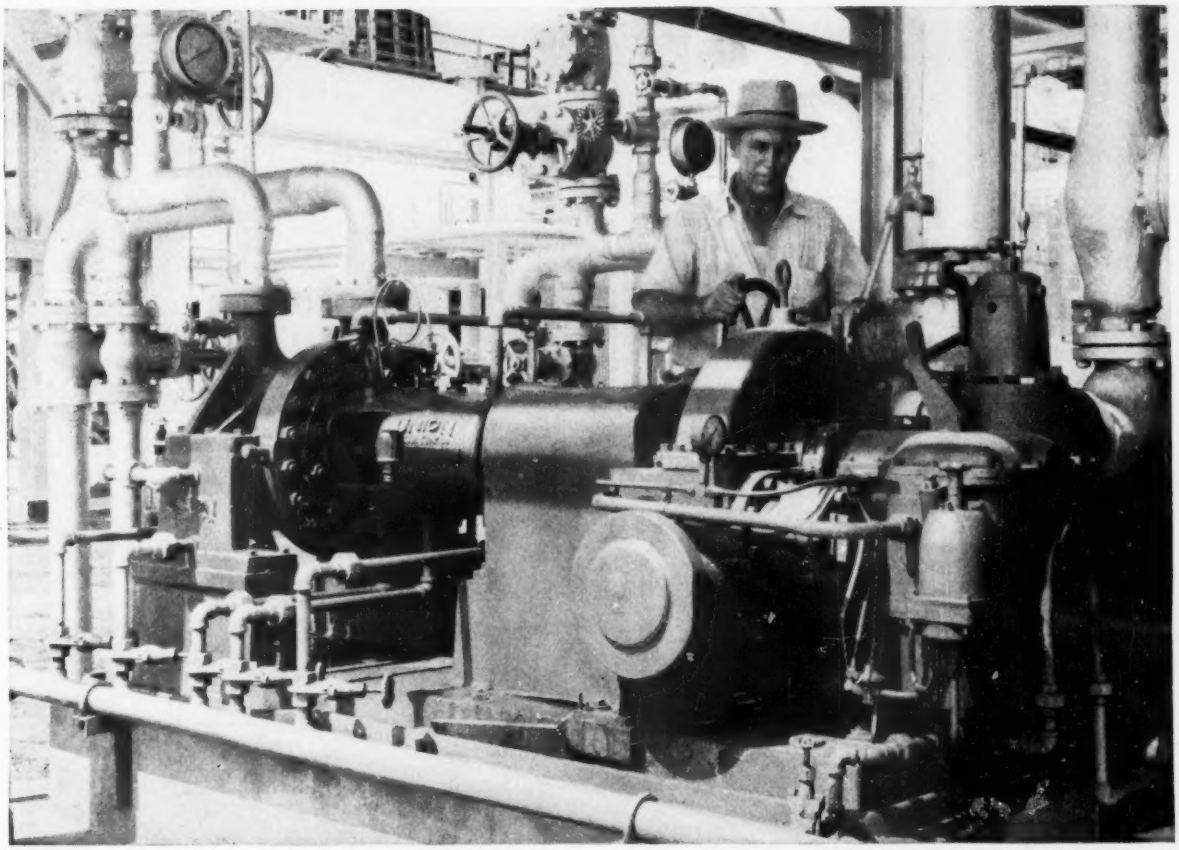
G-E Turbines Save Maintenance,



G-E turbines and motors are paired at McMurrey Refinery to utilize large steam supply efficiently. When process steam demands decrease, surplus steam is economically diverted to turbine drives. These Type DP turbines range from 8 hp to 41 hp.



Shown here is part of a row of ten General Electric Type DP turbine drives and motors, ranging from 9 hp to 48 hp. The many interchangeable parts on these turbines make stocking of spare parts an economical matter.



Maintenance personnel at the refinery have found this General Electric Type DP mechanical-drive turbine, like the many others at the refinery, easy to maintain. This 47-hp turbine at McMurrey Refinery drives a boiler-feed water pump.

Inventory Costs at McMurrey Refinery

Installed to improve steam balance, G-E standard turbines, with many interchangeable parts, also cut inventory costs.

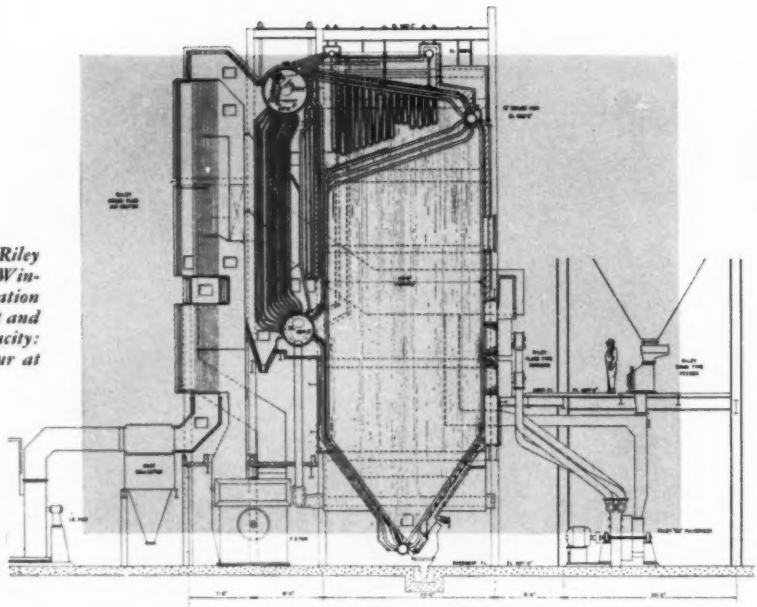
The McMurrey Refinery, Tyler, Texas, installed General Electric mechanical-drive turbines to help regulate steam balance. Since process steam demands range from 30% to 70% of available supply, surplus steam is economically diverted to turbine drives.

Time soon proved that General Electric turbine drives have many other advantages. Mr. Dave Hood, Mechanical Maintenance Foreman at the refinery, states, "With these turbines on the line now for over a year, we're happy to report that they are extremely easy and economical to maintain, requiring very little of our time for maintenance."

Mr. Hood also said, "Since we have quite a few different sizes and ratings of turbines here, we're particularly pleased with the great number of interchangeable parts on these turbines. It certainly cuts down our inventory problem." Interchangeability of a great majority of the replaceable parts (regardless of hp rating) is a big feature with G-E standard turbine drives, which are paired with motors throughout the refinery to help assure uninterrupted service.

Call in your G-E sales-engineer or write for bulletin GEA-4955A, "A New Standard in Mechanical-drive Turbines." Section 252-59, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC



Elevation drawing of Riley Stoker boiler installed at Winslow Steam Electric Station of Superior Water, Light and Power Company. Capacity: 125,000 pounds per hour at 725 psi. and 830° F.

Another big job in operation on schedule...

with ELECTRUNITE BOILER

An important part of the long-range expansion program of Superior Water, Light and Power Company is the recently-completed addition to the Winslow Steam Electric Station.

A Riley Stoker boiler is installed out-of-doors to furnish 125,000 pounds of steam per hour to produce the needed additional 12,650 k-w of power.

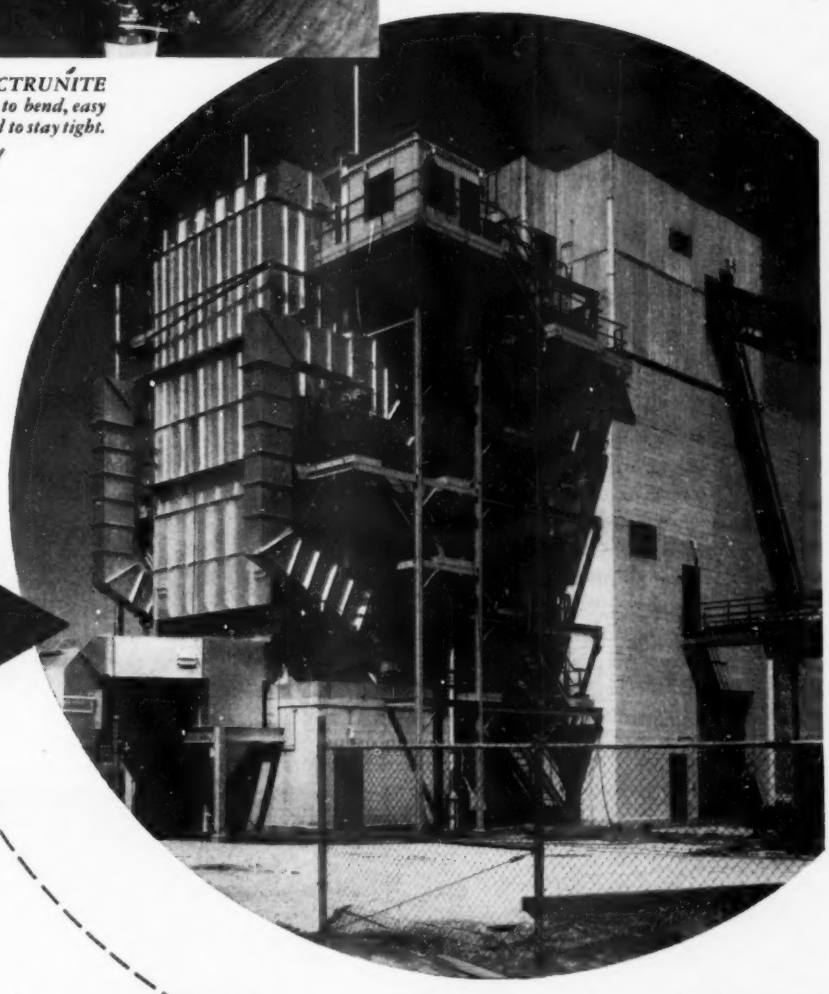
Inside the boiler, Republic ELECTRUNITE Boiler Tubes were installed on schedule to help get this giant steam station on the line.

Republic ELECTRUNITE Boiler Tubes are uniform in wall thickness, uniform in O. D., uniform metallurgically and structurally. They are fully-normalized to make bending and roller-expanding easy and predictable. They are strong to give maximum service with fewer costly retubings.

Specify "Republic ELECTRUNITE Boiler Tubes" for your next new job... order them for your next retubing job. Also available for condensers, heat exchangers, and economizers. Write for engineering data.

STEEL AND TUBES DIVISION
REPUBLIC STEEL CORPORATION
221 STEEL AND TUBES BUILDING • CLEVELAND 8, OHIO

Republic ELECTRUNITE *Tubes are easy to bend, easy to roller-expand to stay tight.*



TUBES

REPUBLIC STEEL

ELECTRUNITE

Out-of-doors installation of Riley Stoker boiler to new 12,650 k-w extension at Superior, Wisconsin. Republic ELECTRUNITE *Boiler Tubes are used to help release 12,800 btu. per hour in the 12,000-cubic-foot furnace.*

Widest choice . . . *for engineered instrumentation*

EACH of the thousands of industrial processes presents its own peculiar problems of measurement and control. Naturally, no single instrument can solve all of these varied problems. Serious compromises would have to be made in performance, convenience, and cost.

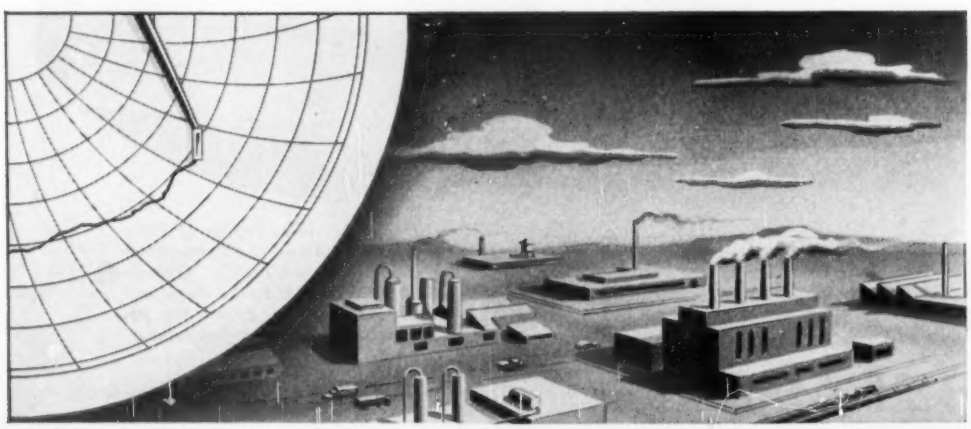
The many Honeywell primary elements, instruments, control systems, and final control elements constitute a uniquely complete family, covering practically the whole spectrum of industrial measurement and control. You can be sure that the combination selected for your job is recommended without bias, and with full consideration for every need of the application.

Included are *ElectroniK* instruments for indicating, recording and controlling a host of variables, in circular and strip chart models; *Tel-O-Set* miniature indicators, recorders and controllers; *Pyr-O-Vane* millivoltmeter controllers; square root and linear flow meters; thermometers; pressure gauges. Electric and pneumatic control systems range from the simplest to the most complex, including fully automatic program control. Primary elements include thermocouples, thermometer bulbs, *Radiamatic* elements, pH assemblies, conductivity cells, flow meter bodies and many others. For final control elements, there is a full range of motorized and diaphragm operated valves. Supplementing these are more than 7000 different non-indicating devices for controlling temperature, pressure, vacuum and other conditions.

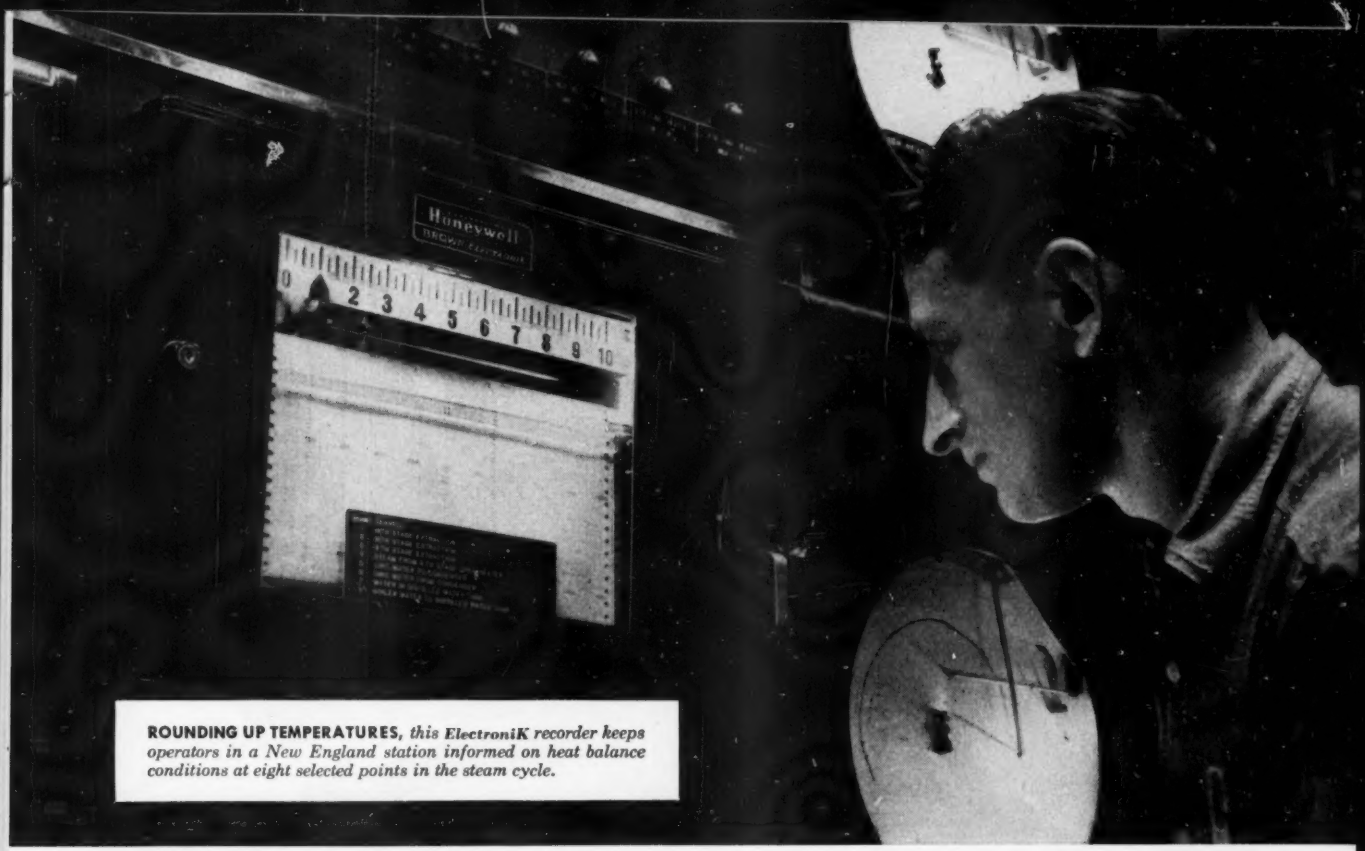
"Building block" approach

These are the building blocks of measurement and control. To combine them into systems custom-fitted to your process, Honeywell offers the know-how gained through years of experience in all branches of industry. Whether your process calls for a single instrument or a complete central control panel, you can be sure of getting the peak in performance and value . . . and the advantages of a single responsibility for the entire installation . . . when you specify *engineered instrumentation by Honeywell.*

Wherever *rely on*



COMPLETE COVERAGE *of industrial requirements for instrumentation is at your command in the Honeywell line. Whatever you need to measure or control . . . to any accuracy . . . with any of a variety of special features . . . you'll find Honeywell instruments offer the most efficient solution.*



ROUNDING UP TEMPERATURES, *this ElectroniK recorder keeps operators in a New England station informed on heat balance conditions at eight selected points in the steam cycle.*

measurement counts...

ElectroniK recorders

FOR ALL the vital measurements that are essential to power plant supervision, you'll get the most in performance with *ElectroniK* recorders. They have every feature that power engineers demand:

They're versatile: the same basic, industry-proved instrument is supplied for measuring temperature, frequency, power, flow, pressure, pH and conductivity. Single and multi-point models are available in a choice of printing speeds and chart speeds . . . readily equipped to operate signals and alarms.

They're accurate: built of life-tested, service-proved components, such as hermetically sealed converters, high-torque balancing motors, and simplified amplifiers. They're unaffected by vibration, atmospheric humidity or dust. They have earned a reputation for staying on the job week after week . . . month after month . . . without interruption.

Behind these instruments stands the largest service organization of its kind, operating from more than 90 offices strategically located in the U. S., Canada, and throughout the world. Ask your local engineering representative for full facts . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4490 Wayne Ave., Philadelphia 44, Penna.

● **REFERENCE DATA:** Write for Catalog 90-2, "Supervisory Instruments for Power Generation."

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

Whose cheese is being divided?

TWO cats could not agree on fair division of a tasty cheese. "Let's go to the monkey," said one, "He is all-wise and can divide our cheese fairly." So to the monkey they went.

The monkey immediately broke the cheese evenly and judicially put the two pieces on the pans of his balance. But one was slightly heavier. He shrewdly nibbled that piece a bit and put it back on the scales. Now it was the lighter piece. So he bit off some of the other piece only to find it the lighter. Thus while the two hungry cats watched, the monkey kept taking bites of the cheese, first one piece, then the other, until finally the cheese had almost disappeared.

"What's left is too small to divide," sagely pronounced the monkey, as he popped the remaining fragments into his mouth.

Observers of the American scene see a direct parallel between the record of federal taxation and this ancient parable of the trusting cats, the greedy monkey and the cheese. Business and the individual citizen have been content to trust government to rule on the disposition of their earnings. And Uncle Sam keeps taking bite after bite out of the shares of both individual citizen and business.

Already government bites are so large as to severely penalize citizens and business alike. If allowed to continue, it will seriously impede further industrial progress and growth, stifle initiative and threaten the strength of our free enterprise system. Beware the day—goal of the socialists among us—when the monkey says, "What's left is too small to divide."

QUALITY V YOUNGSTOWN SERVICE

The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio

Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

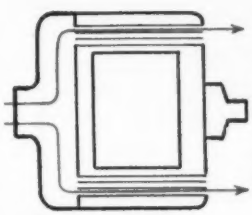
RAILROAD TRACK SPIKES - CONDUIT - HOT AND COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RODS - SHEETS - PLATES.

Your *Best* Motor Buy

for Outdoor Installations

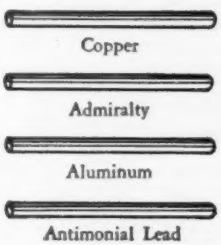
Here's Why

Practically Self-Cleaning



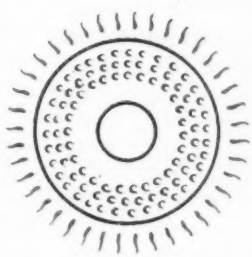
Air-to-air heat exchanger has straight, smooth tubes with no pockets to collect dirt or moisture. Velocity of cooling air through tubes keeps surfaces swept clean. If sticky dirt piles up, tubes can be cleaned quickly with long handled brush.

Choice of Tube Materials



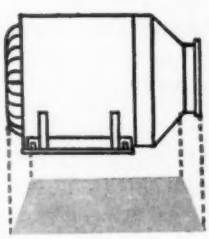
Allis-Chalmers tube-type motors can be built for service in corrosive atmospheres and for outdoor operation in almost any climate. Tubes may be made of a variety of materials, depending on service conditions.

Uniform Cooling



Tubes for carrying cooling air are distributed uniformly around the perimeter of the stator and along its full length. Result: heat travels over a short path and the interior is uniformly cooled.

Compact



Allis-Chalmers tube-type motors are little or no larger than open motors of the same rating. Tube-type design exposes large surface area to cooling air in minimum space.

Get Complete Information Now — Ask your Allis-Chalmers district office representative about tube-type, totally-enclosed fan-cooled motors in sizes up to 3000 hp. Or write Allis-Chalmers, Milwaukee 1, Wis., and ask for Bulletin 51B7150.

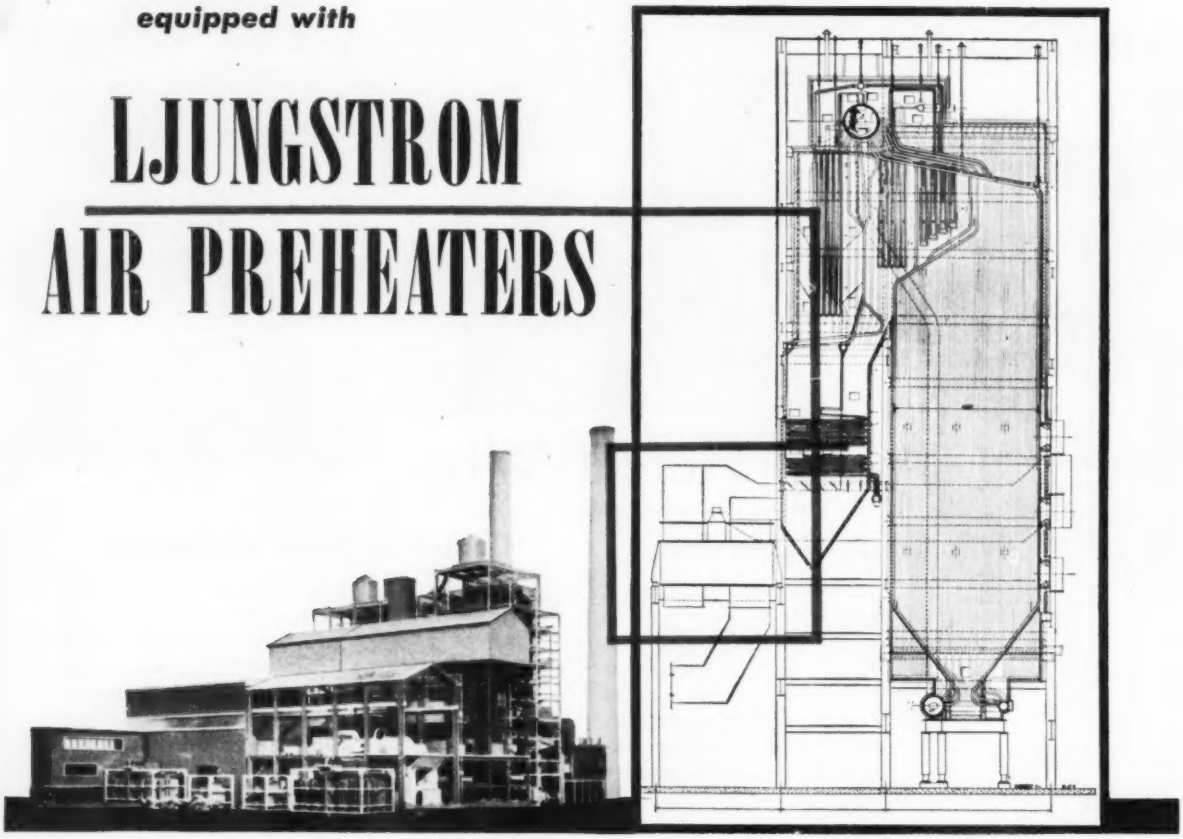
A-3856

ALLIS-CHALMERS

Boilers at new Gadsby Steam Plant of the Utah Power & Light Company . . . .

equipped with

LJUNGSTROM AIR PREHEATERS



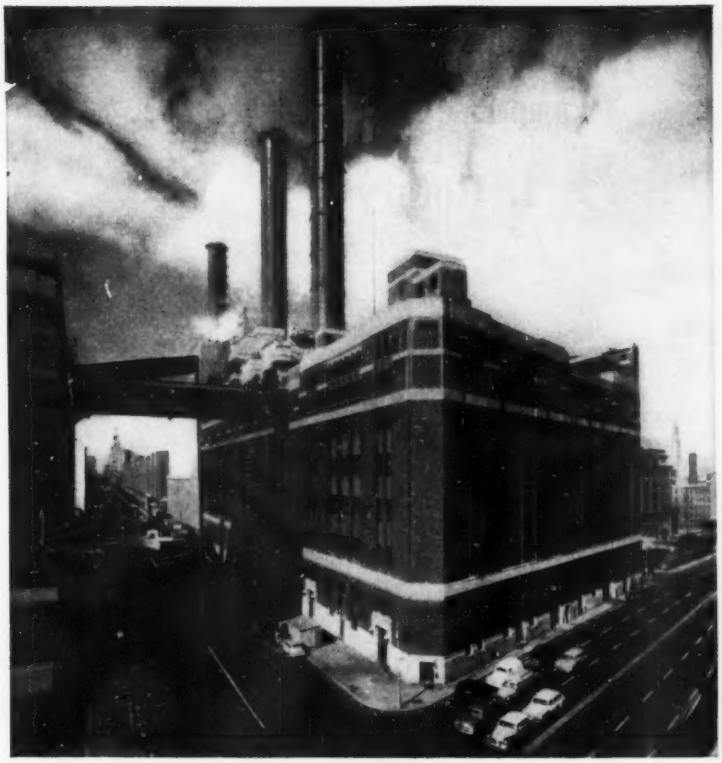
Utah Power & Light Company's new Gadsby Steam Plant, designed by Bechtel Corporation, will utilize, on completion, two Riley Steam Generating Units totalling 1,195,000 pounds of steam per hour capacity.

One unit, shown here, went on the line last August. Fired with petroleum pitch and designed for future pulverized coal firing, it generates 620,000 pounds of steam per hour at 1500 psi and 955 F. The second boiler is scheduled to begin operation late this year. Its capacity will be 575,000 pounds of steam per hour. This unit is designed for 1700 psi and 1000 F, with a reheat cycle at 396 psi and 1000 F. It will be fired with pulverized coal, and will have firing equipment for petroleum pitch.

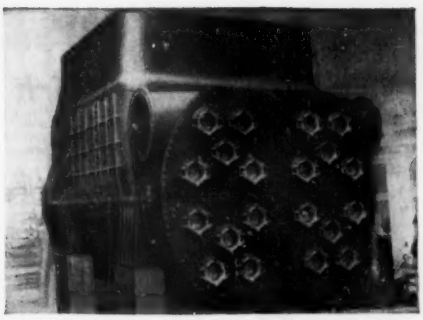
Each of these modern steam generating units has been designed to incorporate a Ljungstrom Air Preheater. The Ljungstrom now in service preheats combustion air to 642 F, cools stack gases to 305 F. The Ljungstrom on the second unit will preheat air to 650 F, cool exit gas to 315 F.

This is another example of the unanimity with which boiler manufacturers have included Ljungstrom Air Preheaters in outstanding recent installations. The effectiveness and dependability of the Ljungstrom Air Preheater have made it a standard for high efficiency steam generating units.

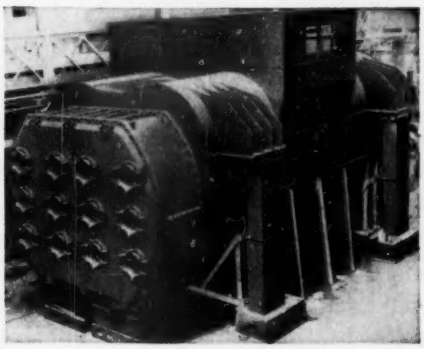
THE Air Preheater Corporation 60 East 42nd St., New York 17, N. Y.



CON EDISON'S EAST RIVER ELECTRIC GENERATING STATION at 14th Street, New York City, will contain the new Worthington 125,000 sq-ft condenser. The shell, which is to be installed under 160,000-kw Unit No. 7, will contain nearly 105 miles of ⅝" O.D. aluminum brass tubes and will require 138,000 gpm of East River water supplied by two 54 in. Worthington "Mixflo" vertical single suction volute circulating pumps.



WORTHINGTON CONDENSER installed in 1931 to serve 160,000-kw Unit No. 7, Hudson Avenue Station. Tube sheets were drilled for 110,000 sq ft with 101,000 sq ft installed.



ONE OF TWO 74,500 SQ-FT 2-PASS WORTHINGTON CONDENSERS serving 60,000-kw Units 14 and 15 at Waterside Station No. 1.

Con Edison once again installs "largest" condenser

On several occasions over the past fifty years, Worthington has been selected to build the "world's largest" surface condensers in single shell design.

In 1919, a 70,000 sq-ft condenser was installed under a 35,000-kw turbine-generator for a prominent utility company. This was the largest single shell surface condenser of its day.

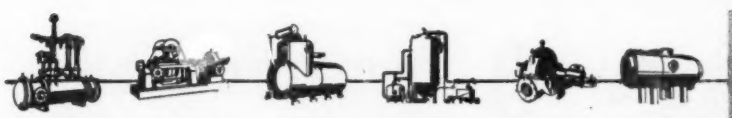
In 1931, Brooklyn Edison Company (now Consolidated Edison Company of New York, Inc.) installed, under 160,000-kw Unit No. 7 at the Hudson Avenue Station, the "world's largest" at that time, a 101,000 sq-ft single-pass Worthington condenser. This was followed, in 1949, by two 74,500 sq-ft condensers for Waterside Station No. 1.

Now, Worthington is again building for Con Edison the "world's largest" single-shell condenser ever ordered, 125,000 sq-ft, single-pass, for the 160,000-kw Unit No. 7 addition to East River Station.

Worthington, with over a century of experience in the manufacture of steam power equipment, is prepared to build efficient condensers in all sizes. Let us advise you, without obligation, on your new installation.

Write, stating requirements, to *Worthington Corporation, Steam Power Division, Harrison, New Jersey.*

Z.2.2



World's Broadest Line of Steam Power Plant Auxiliaries

WORTHINGTON

Condensers

How do you know which

Positive Displacement Pump

is right for your job?

If you've ever suffered the consequences of a wrong choice in pumps, or if you're now making a choice and have some doubts, here's help.

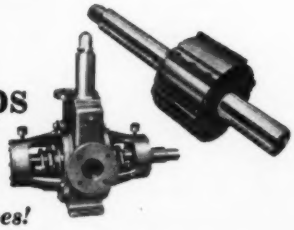
GET THE ADVICE OF A PUMPING SPECIALIST—a manufacturer who makes *all* types of pumps—including all types of positive displacement pumps—and is in a position to treat your problem objectively without the desire to sell you one type over others.

Worthington — oldest and largest pump manufacturer in the world — is equipped to do exactly this for you. With the most complete pump line to choose from, we can always find the one that fits your particular service conditions.

Write and tell us about your pumping problems. Be sure to give all pertinent details! Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, New Jersey.

The Worthington Positive Displacement Pump Line includes all these...

1. Rotary Pumps

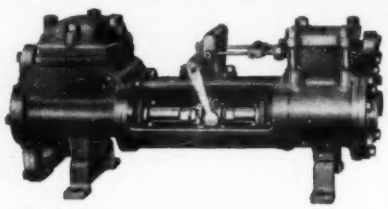


Both gear and vane types!

FOR VISCOUS LIQUIDS—SMOOTH, QUIET OPERATION. *Worthington Herringbone-Gear Pumps*, Types GA and GR; capacities from 1 to 5,000 gpm; pressures to 500 psi.

FOR NON-LUBRICATING, SLIGHTLY ABRASIVE OR CORROSIVE LIQUIDS. *Worthington Sliding-Vane Pumps*, Types VE and VR; external or internal bearings; capacities from 25 to 1,000 gpm; pressures to 200 psi.

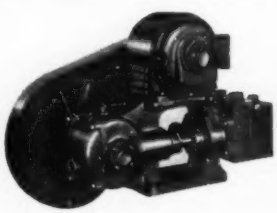
2. Steam Pumps



If you use steam, why not drive pumps with it?

Steam ends up to 250 psi maximum working pressure, hydrostatically tested to 375 psi. Hot-oil or cold-oil fitted. Simplex and duplex. All types: large and small; low pressure, high pressure; for general, boiler feed, refinery, steam heating and evaporator service.

3. Power Pumps



Up to 2,000 hp!

Small capacity, moderate pressure, for fluid transfer, refinery or general service. Large capacity, high pressure, for pipeline and hydraulic service.

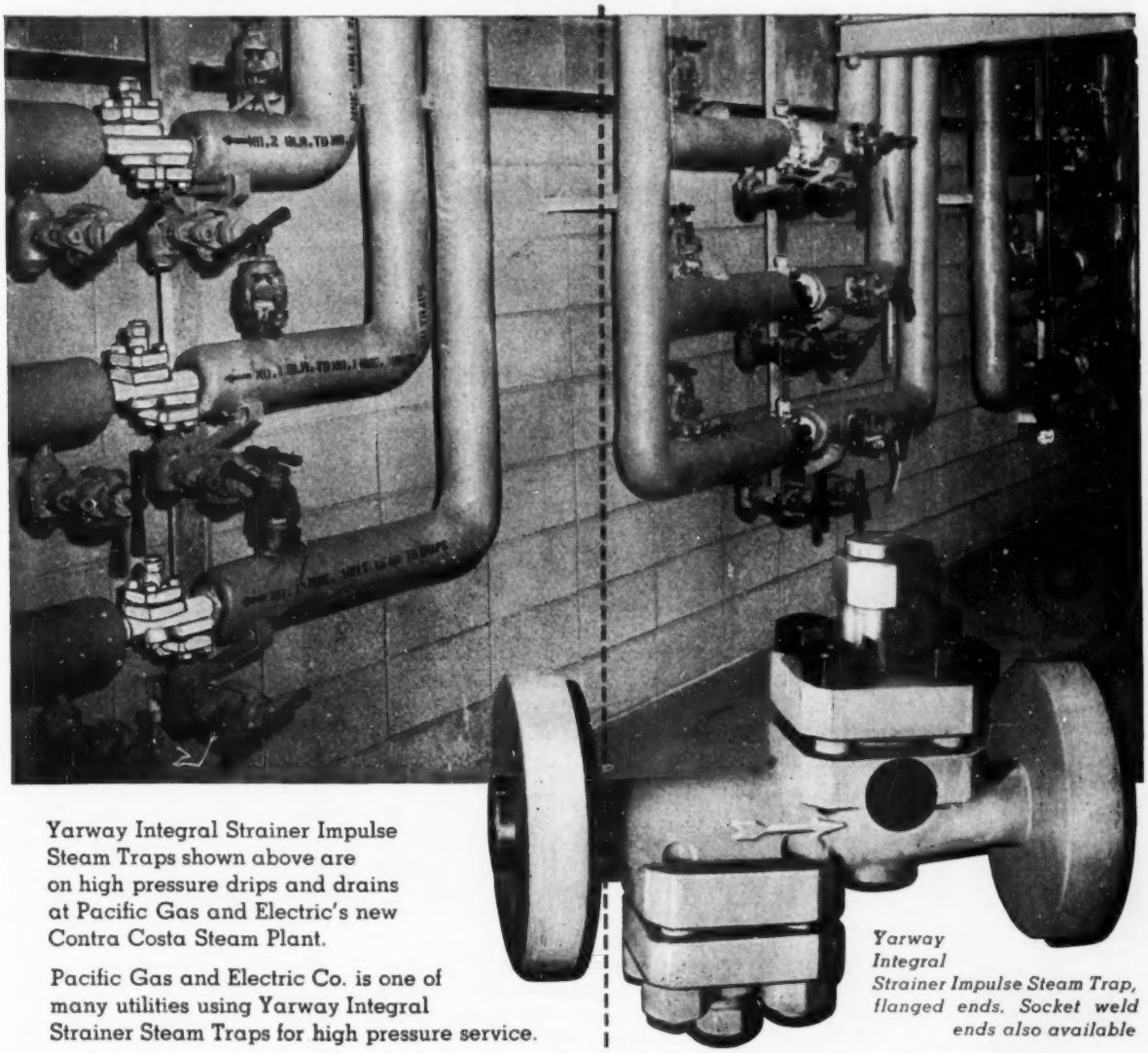
P.2.7

The World's Broadest Line Assures You the Right Pump for Every Job

WORTHINGTON

Reciprocating and Rotary Pumps

trapping high pressure drips and drains at P.G.and E.



Yarway Integral Strainer Impulse Steam Traps shown above are on high pressure drips and drains at Pacific Gas and Electric's new Contra Costa Steam Plant.

Pacific Gas and Electric Co. is one of many utilities using Yarway Integral Strainer Steam Traps for high pressure service.

Yarway Integral Strainer Impulse Steam Trap, flanged ends. Socket weld ends also available

Yarway Impulse Steam Traps drain some of the hottest steam lines in the country . . . and meet all requirements on pressures up to 1500 psi. They have ample capacity when system is being "warmed up"—yet will handle relatively small amounts of high temperature condensate without losing prime. In presence of dry or superheated steam, the trap valve closes.

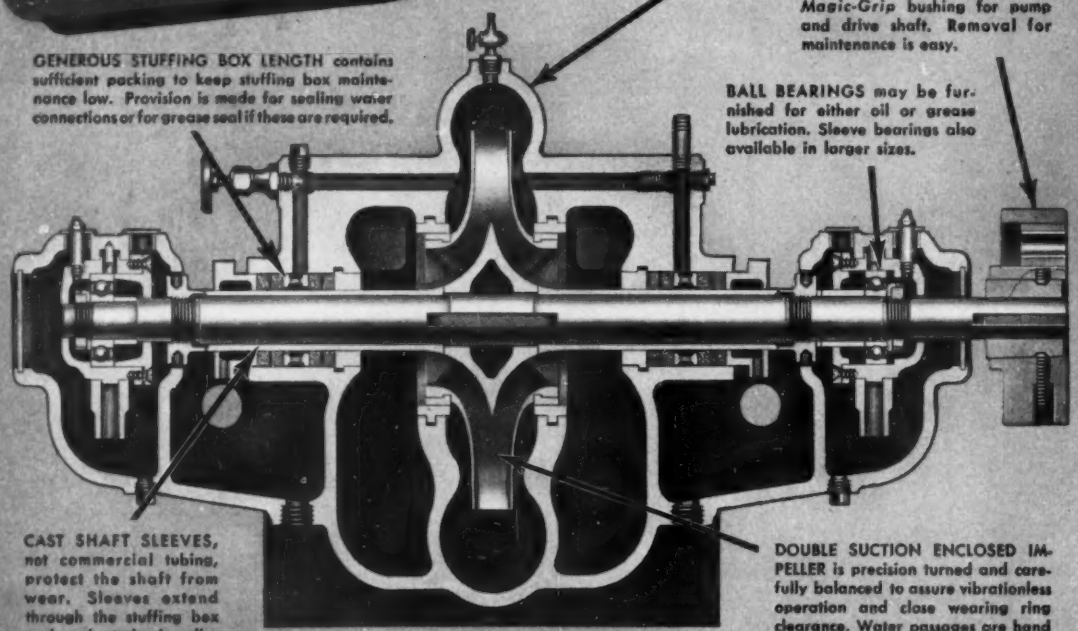
Small size simplifies installation. No special supports needed (see picture).
Easy maintenance—only one moving part.
For full details, send for Yarway Bulletin T-1740.

YARNALL-WARING COMPANY • 100 Mermaid Avenue, Philadelphia 18, Pa.

[redacted] **impulse steam trap**

ALLIS-CHALMERS

Double Suction PUMPS



STANDARD AND SPECIAL MATERIALS available for many types of service where government regulations permit. Iron, bronze, stainless steel and combinations of these materials handle both alkaline and acid solutions.

HEAVY, HORIZONTAL SPLIT CAST IRON CASING construction with suction and discharge nozzles located in lower half for easy inspection without disturbing piping.

COUPLINGS are usually of the pin and rubber bushing type with *Magic-Grip* bushing for pump and drive shaft. Removal for maintenance is easy.

GENEROUS STUFFING BOX LENGTH contains sufficient packing to keep stuffing box maintenance low. Provision is made for sealing water connections or for grease seal if these are required.

BALL BEARINGS may be furnished for either oil or grease lubrication. Sleeve bearings also available in larger sizes.

CAST SHAFT SLEEVES, not commercial tubing, protect the shaft from wear. Sleeves extend through the stuffing box and seal at the impeller hub.

STANDARD SIZES carried in stock range from 10 to 7000 gpm with heads as high as 475 feet. Larger sizes are available.

DOUBLE SUCTION ENCLOSED IMPELLER is precision turned and carefully balanced to assure vibrationless operation and close wearing ring clearance. Water passages are hand finished to a smooth surface.

Built for LONG LIFE

HEAVY DUTY CONSTRUCTION—no skimping, no corner cutting—is what you can look for in Allis-Chalmers Type S pumps. Extra metal thicknesses, extra strong parts, extra construction features, and extra careful workmanship are always there to give you long life, low maintenance and low cost per gallon pumped.

Every Allis-Chalmers double suction pump is carefully tested on the most modern pump testing equipment in the industry. Each installation is individually engineered by men whose experience in thousands of pump installations will give exactly the right pump for your needs.

Allis-Chalmers can take full responsibility for your pumping operation because Allis-Chalmers can furnish the complete installation — pump, motor, control and drive—all built of coordinated design by one manufacturer. Efficient operation is assured and maintenance costs are kept low.

Whatever your pumping problem, call your nearby Allis-Chalmers Authorized Dealer or District Office. Or write to Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 08B6146.

A-3580

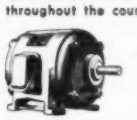
Texrope, Vari-Pitch and Magic-Grip are Allis-Chalmers trademarks.

Sold . . .

Applied . . .

Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.



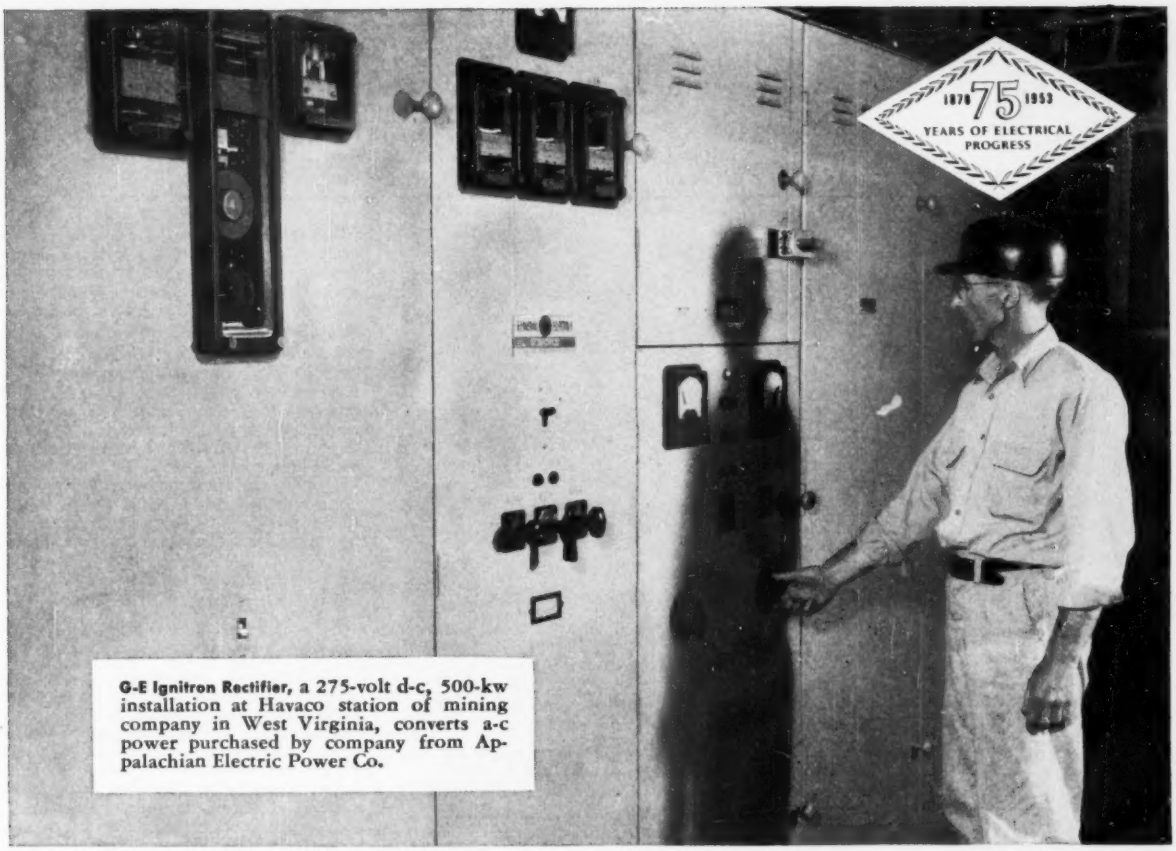
MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

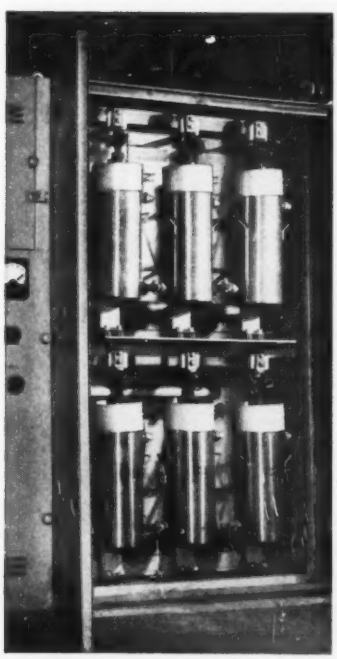
FREE slide films on pump theory, application and maintenance. Ask your Allis-Chalmers representative.

ALLIS-CHALMERS



G-E Ignitron Rectifier, a 275-volt d-c, 500-kw installation at Havaco station of mining company in West Virginia, converts a-c power purchased by company from Appalachian Electric Power Co.

8 years of dependable operation



Six tubes for power. Rectifier features simple design, no major moving parts to wear out.

G-E Ignitron Power Rectifiers, requiring minimum maintenance, operate at top efficiency under rugged mining conditions.

For round-the-clock service, year in and year out, G-E Ignitron Rectifiers give dependable d-c power under most adverse circumstances.

In the mountainous, isolated areas of West Virginia's mining country, for example, seven General Electric rectifier substations, all equipped with Ignitron Rectifiers, have serviced mines of a large coal producing company in the New River and Pocahontas fields since 1944. And over this 8-year period, the company reports, the G-E Ignitron Rectifiers have given safe, and near continuous service—with very low overall maintenance costs.

Proved-in-service G-E Ignitron Rectifiers are chosen for these hard jobs because they provide maximum protection to operating personnel . . . possess an efficiency generally higher than rotating power-conversion units . . . have no major moving parts that need replacement or require extensive upkeep. And they are reliable. If regular inspection periods are maintained, G-E Ignitron Rectifiers can be left unattended, for months at a time, with the assurance they will give satisfactory service during all that period. Supplied as a complete packaged unit with transformer and metal-enclosed switchgear, the installation occupies minimum space.

Call or write your nearest G-E sales office for information on a G-E Ignitron Rectifier to fit your d-c power requirements. General Electric Company, Schenectady 5, N. Y.

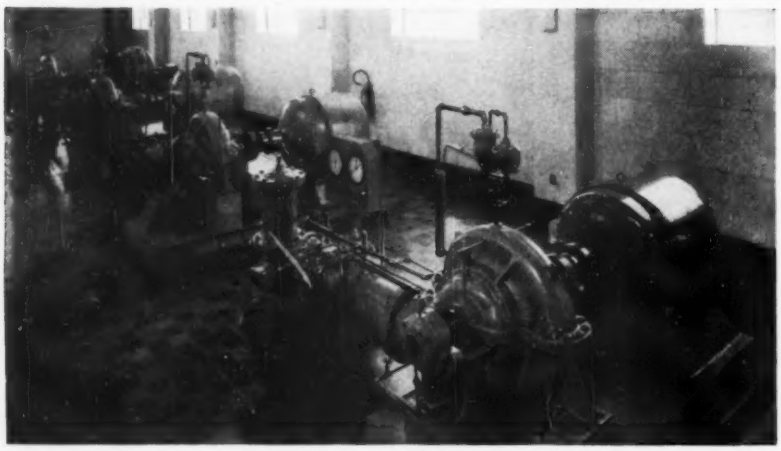
324-6

GENERAL ELECTRIC

WORTHINGTON

POINTERS ON PUMPS

Prepared for Industry by Worthington Pump and Machinery Corporation



A Plan That Gets the Most out of Centrifugal Pumps

Easy-To-Install Maintenance Program Means Better Performance, Longer Life

You can't get maximum production when your equipment's operation is constantly interrupted due to breakdowns. Moreover, today's equipment shortages make it increasingly more important that you get all the life you can out of your present machines.

We'd like to suggest a maintenance plan that will help you get the most out of one of your most vital pieces of equipment—centrifugal pumps.

Keep Informative Records

If you haven't already done so, it's a good idea to begin your maintenance plan by setting up a card index file so that you can catalogue each pump in your plant. Each card should contain the following information: plant pump number, size, manufacturer's name and style, serial number, date installed, and any other data which will help you to rapidly locate repair parts lists and manufacturer's parts numbers.

The rest of the card can be divided into a number of columns: Repair Date, Part Affected, Remarks, and Cost. A typical card is shown here.

PUMP MAINTENANCE CARD

_____PUMP NO.	_____MANUFACTURER
_____SIZE	_____MFGR'S ADDRESS
_____DATE INSTALLED	_____MFGR'S SERIAL NO.
_____LOCATION	_____MFGR'S STYLE

DATE	PART	REMARKS	COST

If you're careful to enter every maintenance or repair operation on the proper card, it won't be long before each card indicates a particular pattern of maintenance.

Set Up A Maintenance Schedule

Once this pattern is established for all the cards, you can set up a schedule of maintenance points for such items as: packing, greasing or oiling, painting, gasket replacement, and bearing examination. You may find, for example, that a unit or group requires packing maintenance about once every three months, and greasing once every four to six months, etc.

Your next step is to arrange a plant schedule so that a particular pump may be shut down for maintenance at or before these times. Thus you make it possible to do the maintenance work under proper and unhurried conditions to assure maximum conformity of production consistent with long pump life. In addition, examination of the card catalogue will guide operating and maintenance personnel as to quantity of repair parts they should keep on hand.

Make Periodic Inspections Externally

It is considered *inadvisable* to open pumps for inspection.

Rather, recent practice is to let pumps stay on the line until such time as external symptoms indicate overhaul may be required. These symptoms involve either a reduction in effective capacity because of wear at the internal clearance points or mechanical difficulties, such as vibration or noisy operation.

Parts requiring most frequent replacement in centrifugal pumps are: wearing rings, shaft sleeves, packing and bearings.

The most important maintenance point on process pumping equipment is the stuffing box. It must be kept clean, cool, and lubricated—but *packing* is the crucial operation. A good packing method will be discussed in a later edition of *Pointers on Pumps*.

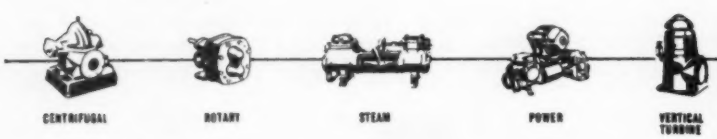
Don't forget the frames, base plates, and supporting parts of your pumps. Good housekeeping often makes it easier to do a good overall maintenance job!

Can We Help You?

Worthington makes more *standard* pumps than any other manufacturer. Don't buy a "special" (at a higher price) without checking to see if Worthington makes it *standard*.

If you *do* need a special, remember Worthington's modern engineering facilities, backed by the longest and broadest experience in the field. Contact our nearest District Office or write to Worthington Corporation, Centrifugal Pump Division, Harrison, N. J.

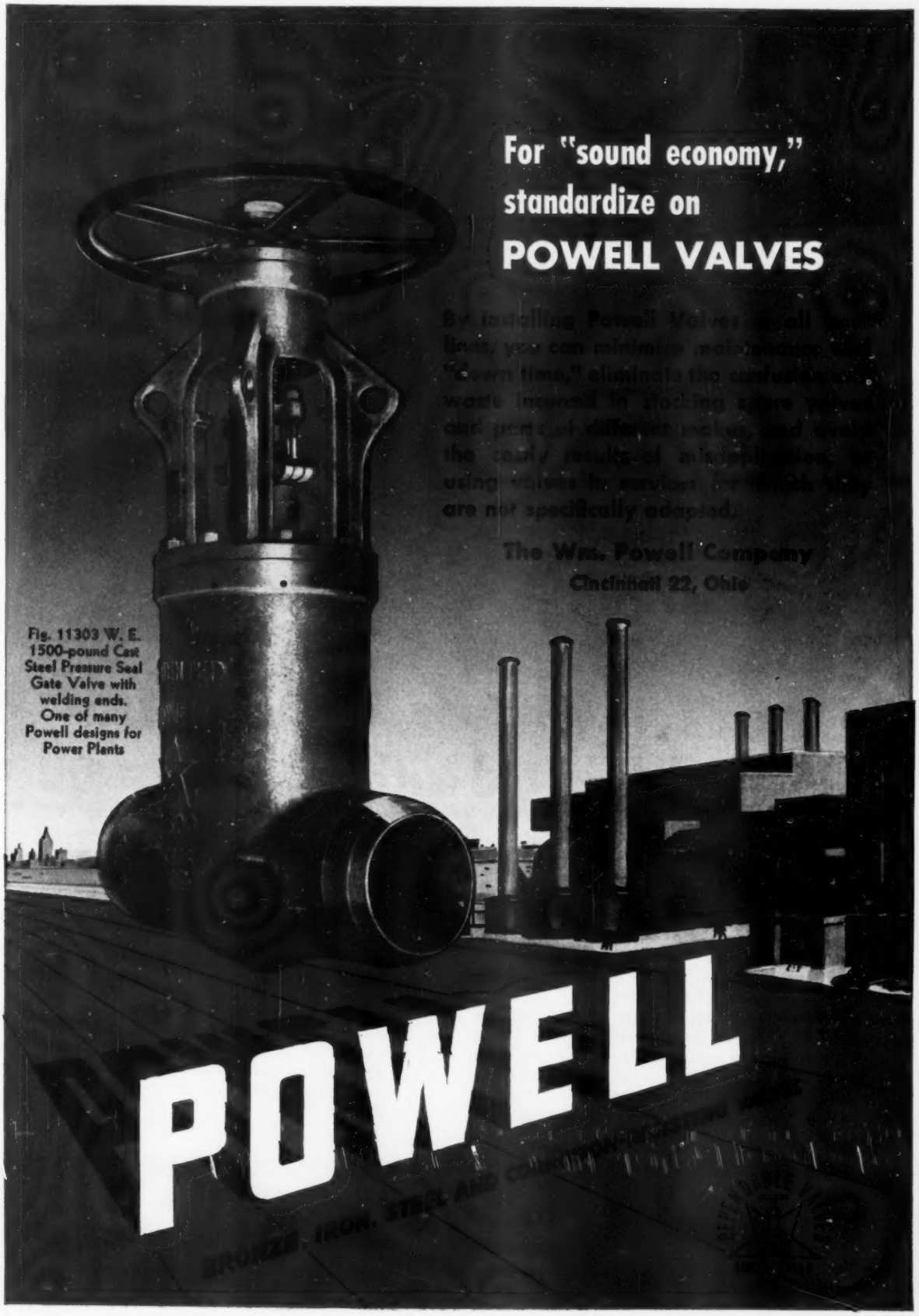
C.2.2



The World's Broadest Line Assures You the Right Pump for Every Job

WORTHINGTON

Centrifugal Pumps


For "sound economy," standardize on
POWELL VALVES
By installing Powell Valves in all your lines, you can minimize maintenance and "down time," eliminate the confusion and waste incurred in stocking spare valves and parts of different makes, and avoid the costly results of mis-application or using valves in services for which they are not specifically adapted.
The Wm. Powell Company
Cincinnati 22, Ohio
Fig. 11303 W. E. 1500-pound Cast Steel Pressure Seal Gate Valve with welding ends. One of many Powell designs for Power Plants
POWELL
BRONZE · IRON · STEEL

IN 20 YEARS — NO STUCK RINGS

...for Tulia, Texas, Diesels lubricated with Texaco Ursa Oil

FOR 20 years, the power plant for the City of Tulia, Texas, has been operating a 550 h.p. Fairbanks-Morse Model VA Diesel — lubricated exclusively with one of the famous *Texaco Ursa Oils*. Never once has there been a stuck ring. Regular inspections and major overhauls have invariably found the engine exceptionally clean. Wear has been slight, maintenance costs very low.

Thus, when the City of Tulia installed two new Model 31 Fairbanks-Morse Diesels in 1949, it was only natural that the lubricant chosen should be *Texaco Ursa Oil*. All three engines are running perfectly.

There is a complete line of *Texaco Ursa Oils*. Whether you're operating Diesel, gas or dual-fuel engines, you can get a *Texaco Ursa Oil* exactly right to give you top performance at lowest possible operating cost. That is one reason why —

For over 15 years, more stationary Diesel h.p. in the U. S. has been lubricated with Texaco than with any other brand.

Let a Texaco Lubrication Engineer help you get greater efficiency and worthwhile savings from *your* operation. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO URSA OILS

FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE, on television Tuesday nights. METROPOLITAN OPERA radio broadcasts Saturday afternoons.

Maintenance Is Booming

IN THE WEEK of January 19, Cleveland will welcome the fourth annual Plant Maintenance Show and Conference. Last year's in Philadelphia set a world record, yet the 1953 Show and Conference will be bigger and better in every way. Number of exhibitors will grow from 276 to over 300, Conference registration from 2000 to 2500, and total attendance at Conference and Show from 14,000 to 16,000. This year there will be 61 conference sessions plus the banquet.

The general conference sessions, in particular, are an amazing demonstration of industry's practical concern with maintenance. Last year 2000 engineers sat down together in one session to discuss lubrication. And 2000 gathered again to debate preventive maintenance.

These are startling statistics. Yet it now seems likely that some of the individual sessions at Cleveland this year will bring together as many as 2500 engineers who are vitally concerned with doing a better maintenance job. Nothing like this has ever happened before.

For this booming evidence of interest in maintenance there are many reasons. One is the fact that maintenance men are at last finding a time and place to get together. Another is the present inflated hourly cost of maintenance labor. Still others are the growing complexity of industrial machinery and the increasing insistence on reliability and on continuous operation.

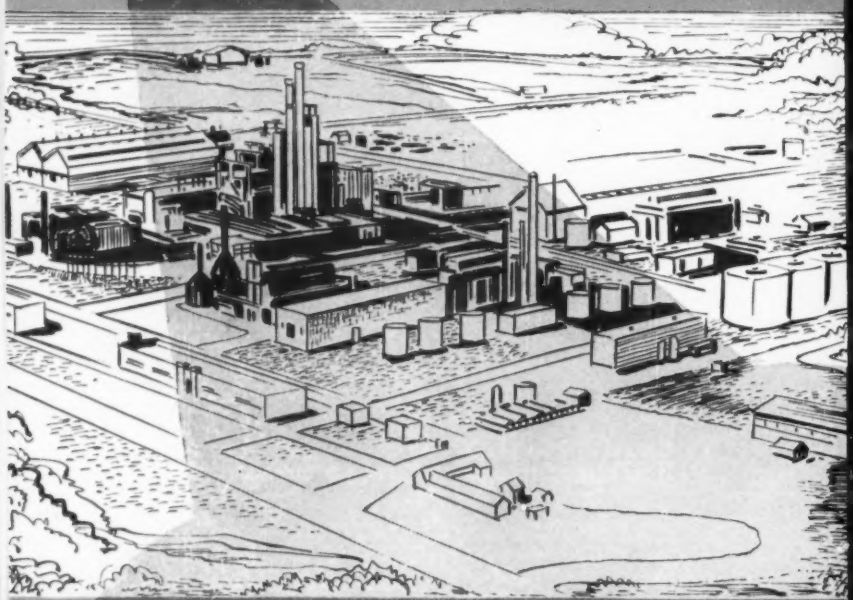
As our readers are well aware, POWER has been hammering away at practical maintenance for nearly three-quarters of a century. Every month now our Plant Operation and Maintenance Section carries many articles and items showing better ways to maintain all kinds of power equipment. And this month, to tie in still closer with the Show and Conference, every article in this section is focused on some practical maintenance problem.

Starting on page 103, you will find a great variety of useful methods and suggestions: Coating condenser tubes and pump impellers with neoprene to cut corrosion—revamping a feedwater system—a better way to remove sludge from fuel-oil tanks—an amazingly ingenious way to regrind a sprung diesel crankshaft *in place*—how to tell just when to overhaul a pump—how to ground portable electrical tools—tips that will get you out of tight spots with electrical equipment—maintenance tips for refrigeration—check list for the maintenance of heating systems (steam, hot water, hot air)—and many other maintenance ideas in the regular departments.

Yet, all in all, this is just a little more than our usual monthly diet of maintenance material, for as we said at the start, POWER's interest in this subject is continuous. Telling the story of p. .tical maintenance is a year-round job for an editorial team broadly experienced in every phase of power-service generation and application.

A STEAM TRAP CASTS A

BIG effects from little traps! And, the effects are multiplied by the number of traps in the plant you design or operate until they grow to be a *major* influence upon operating efficiency and economy. Before you specify steam traps ask your nearby Armstrong Representative to call. He is qualified to give you practical assistance and answers that can save you a lot of time and trouble.



THINGS STEAM TRAPS AFFECT

1. **HEAT-UP OR START-UP TIME**
2. **RATE OF PRODUCTION**
3. **STEAM WASTE**
4. **FUEL WASTE**
5. **CONTINUITY OF OPERATION**
6. **MAINTENANCE COST**

Cast semi-steel side inlet — side outlet series. ½", ¾" and 1" pipe connections.

Cast semi-steel bottom inlet — top outlet series. ½", through 2" pipe connections.

Forged steel series for high pressures to 1500 psig and for low and medium pressures where all-steel fitting! are desirable.

ARMSTRONG MACHINE WORKS

812 Maple St., Three Rivers, Michigan

It Pays to Specify

ARMSTRONG

MIGHTY BIG SHADOW

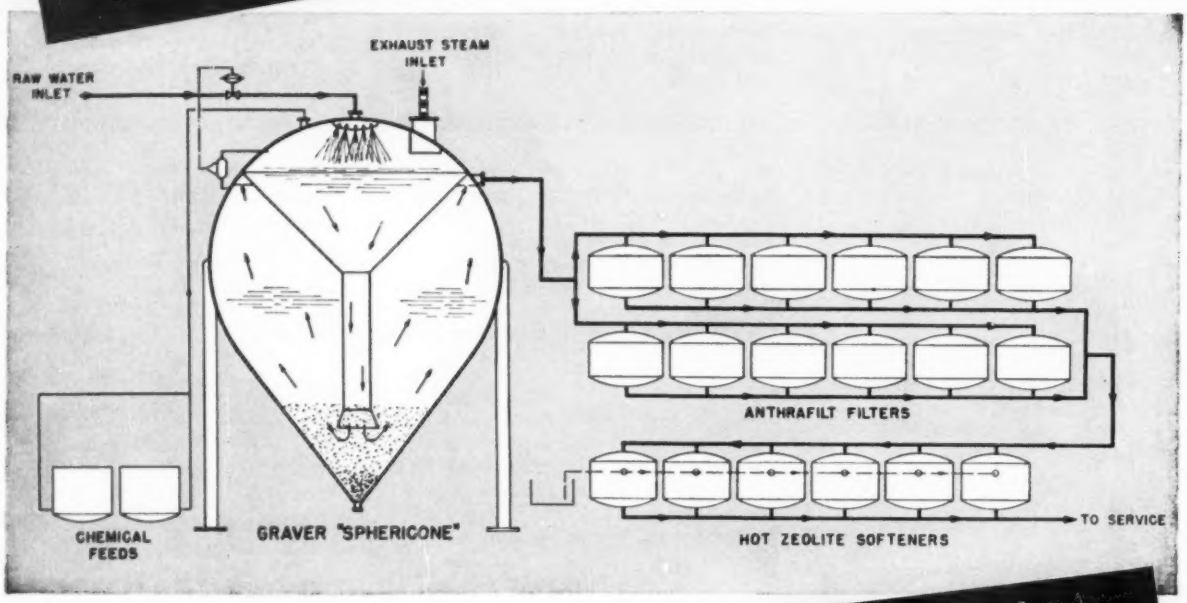
REASON	HOW ARMSTRONG TRAPS MEET THE NEED	EXAMPLE
When steam is turned on, large amounts of condensate *and air* must be removed before equipment heats up.	Condensate *and air* removed as fast as they reach trap. Reliable data insures you get trap with adequate safety factor to meet conditions.	*40 Minute Faster Heat-up*—drying oven at pharmaceutical plant heats up 40 minutes sooner with Armstrong "Blast" traps.
Quick heat-up, maximum temperatures essential for maximum output.	Air which reduces temperature and heat transfer discharged automatically; condensate discharged at steam temperature; equipment kept *full* of hot, dry steam.	*30% Greater Output* — jacketed kettles produce 30% more at Canadian plant since changing to Armstrong traps.
When steam gets past traps, boiler capacity may be inadequate—this is bad even if you could afford the fuel waste.	When steam floats the bucket the trap closes. No steam ever reaches discharge orifice, even when there is no condensate load. Heat treated chrome steel valve parts, precision ground and lapped, resist wire drawing and wear, stay leak tight for a long, long time.	*Steam Savings Eliminate Need for New Boiler*—chemical plant shelves plans to buy larger boiler after installing Armstrong Traps.
Why burn fuel to generate steam that does no useful work . . . blows through traps, for example?		*33⅓% Reduction in Fuel Bill* — after trapping vats with Armstrongs at Missouri plant.
When traps are inoperative or down for repairs, unit being drained may be "off the line."	Nothing to clog, seize, stick or collapse! Large orifice. Self-scrubbing action cleans out ordinary dirt and scale. "Frictionless" leverage with wear points heavily reinforced for long life. Hardened chrome steel valve and seat. Wear and corrosion-resistant stainless trim.	*Maintenance Time Cut 30%* — Illinois user says, "Unequalled dependability, simplicity of design means repairs can be made quickly" (with minimum equipment downtime).
Traps that don't "wear well" take a lot of manhours for repair.		*50% Less Trap Maintenance* — only half as many manhours devoted to traps since installing Armstrongs throughout large Midwestern plant.

SEND FOR THE *NEW* ARMSTRONG STEAM TRAP BOOK

Fresh off the press — 44 pages of practical trapping data. Tells how to select traps for nearly every class of equipment; explains safety factors; gives prices, physical data, service pressure ratings of Armstrong traps; includes recommended installation, maintenance and trouble-shooting practice; contains many time-saving charts and tables — condensing rates, trap capacities, trap size recommendations and others. For your free copy, call your local Armstrong Representative or write to Armstrong.

STEAM TRAPS

World's Largest HOT PROCESS- Hot Zeolite Plant



When a large eastern refinery wanted the most modern, efficient and economical treating system to handle 200,000 gph of feedwater ... virtually 90 to 100% make-up ... for their 650 psig boilers, their engineers selected a GRAVER Hot Process-Hot Zeolite plant employing GRAVEX styrene zeolite.

Advantages of this type of Water Conditioning System

This Graver water treatment with hot zeolite was chosen because it offered these advantages over a hot process softener with hot phosphate after-treatment:

1. **Lower hardness in feedwater.**
2. **Lower CO_2 in steam because of lower alkalinity.**
3. **Lower chemical operating costs.**
4. **Low silica in feedwater.**
5. **A uniformly low hardness in feedwater with possible rapid variations in raw water composition.**

The plant includes a single GRAVER SPHERICONE Hot Process Sedimentation Tank ... also the largest in the world ... to handle the entire water supply. This exclusive tank design gives greatest clarity of effluent, and at the same time provides greatest economy in steel and manufacturing cost. • **Write for further information on the application of this type of GRAVER Water Conditioning System to your own feedwater needs.**

BY GRAVER

Facts about the GRAVER equipment in this plant

- One GRAVER SPHERICONE Hot Process unit 43 ft 6 in dia x 60 ft high.
- Six GRAVER Hot Zeolite Softeners, each 10 ft dia x 5 ft 6 in high.
- Twelve GRAVER Anthrafilt Filters, each 11 ft dia x 5 ft high.
- GRAVER Chemical Feeders.

●●●●●

Write for Technical Articles: "Hot Zeolite Softening" and "Factors in Hot Process Softener Design and Operation."

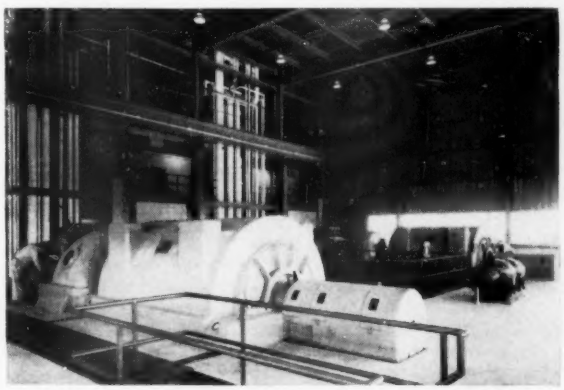
GRAVER

GRAVER WATER CONDITIONING CO.
Division of Graver Tank & Mfg. Co., Inc.
DEPT. P-HP, 216 WEST 14th STREET, NEW YORK 11, N.Y.

Power
JANUARY 1953

30,000-KW WM J NEAL PLANT standing on plains of North Dakota depends on subsurface water for all cooling and makeup needs. Short haul over private railroad delivers low-cost lignite. All mechanical equipment enclosed against severe climate

Short-haul lignite delivery, adequate ground water for station makeup, nearness of transmission line route, growing load on three interconnected systems were all considered in choosing site of Wm J Neal Station, Central Power Electric Cooperative, Incorporated, N.D.



TWO 15,000-KW TURBINES are expected to develop total capability of 45,000 kw during peaks, are cross connected

Neal Station Burns Pulverized Lignite

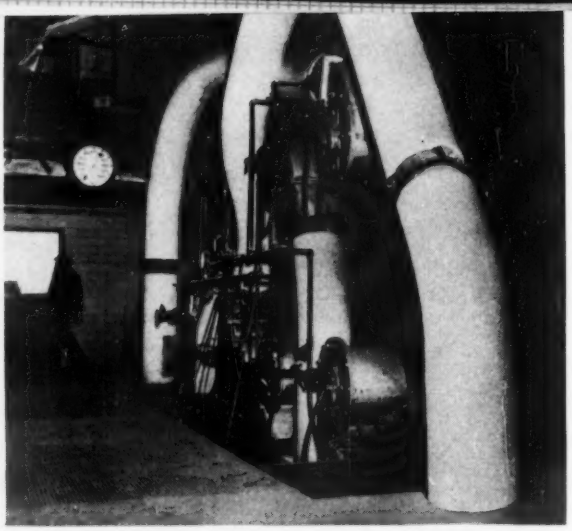
By **D W DeLAURIER**, *General Manager, Central Power Electric Cooperative, Inc*
and **R. L. HEIN**, *Mechanical Engineer, Vern E Alden Co, Consulting Engineers*

► EARLY IN 1950 we realized that the power-generating facilities of North Dakota had to be expanded. The Otter Tail Power Co load was growing and the Bureau of Reclamation wished to develop standby steam for hydro developments on the Missouri River. The eight distribution cooperatives forming the Central Power Electric Cooperative needed a large additional power source in the near future. These three major systems are interconnected.

The Central Electric Cooperative started work on the Wm J Neal Station during May 1950. When dedicated in June 1952, it was the largest lignite-burning plant in northern U.S.A. The station raised North Dakota's generating capacity by one third.

Site and Structure. Neal Station could be considered a mine-mouth plant. After careful study it was placed 30 miles southeast of Minot, North Dakota. An unlimited supply of lignite, over a very short haul on a private railroad achieved a substantial fuel-cost saving. An adequate water supply for cooling-tower makeup was available. In addition the location was convenient to transmission lines. (*Turn page*)

CENTRAL CONTROL ROOM supervises plant, has electrical board at far end, doesn't include soot blowing, lighting off



SIX BURNERS ON EACH BOILER for burning lignite are fed by three mills which produce total of 60,000 lb per hr fuel

Because of the very cold winter climate and strong prevailing winds, enclosures house all equipment. They are heated and large enough to do all operating and maintenance indoors. Insulated stainless-steel curtain walls enclose the main building and the circulating-water pump house. This material makes a good weatherproof barrier, economical in first cost, installation and maintenance.

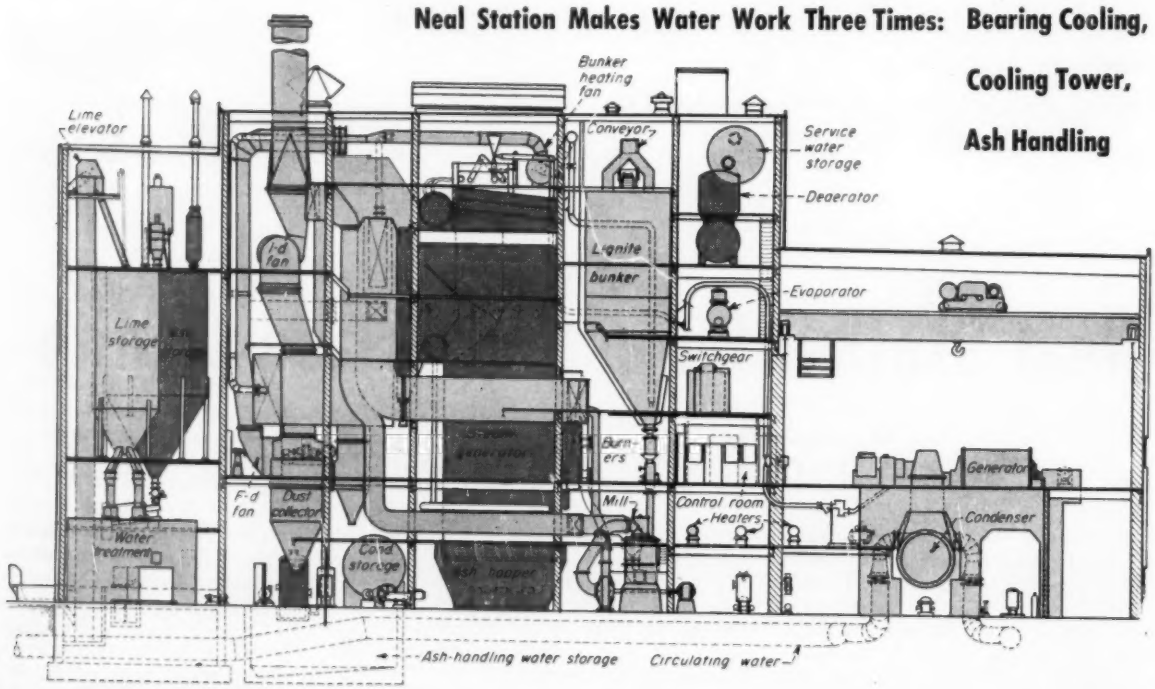
Transite curtain walls enclose coal-handling equipment. This material is generally more satisfactory for unheated spaces. Deepwell and pumping equipment stand in electrically heated reinforced-concrete enclosures.

Heat-Balance Cycle. Of four extraction points in the turbine, the two highest feed closed feedwater heaters. Normally the second point feeds the evaporator also, but for sustained low loads, the first point is used instead. The third point feeds the deaerating heater and the fourth a closed heater.

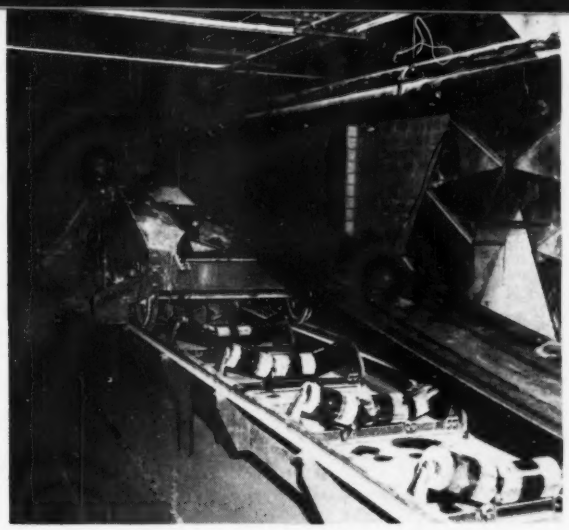
The high-pressure heater has a desuperheating section. In addition to heating feedwater it also supplies saturated steam for building heating. This arrangement saves energy thermodynamically and also in first cost of equipment.

H-p heater drains normally cascade to the deaerator. During low loads there may not be enough pressure to push these drips up to the deaerator,

Neal Station Makes Water Work Three Times: Bearing Cooling, Cooling Tower, Ash Handling



PLANT CROSS SECTION indicates all mechanical equipment that is housed in main building, division walls between sections are largely eliminated. Cross connections between units at several points allows common or isolated operation



CONVEYOR-BELT TRIP delivers lignite into top of sealed bunkers, which stand above pulverizers on station ground level

STEAM GENERATOR PREDICTED PERFORMANCE

Burning lignite with HHV = 6600 Btu per lb; 25% excess air at boiler outlet 28% at air-heater outlet; 15.7% CO_2 at boiler outlet; 905-F superheater outlet steam temperature, 865 psig, 80-F air temperature.

1. Steam output, lb per hr	150,000	230,000	260,000
2. Furnace heat release, Btu per cu ft per hr	12,000	18,000	20,300
3. Burners operating, number	4	6	6
4. Lignite supplied, lb per hr	31,400	47,000	53,000
5. Gas leaving air heater, lb per hr	231,000	344,000	390,000
6. Air to furnace, lb per hr	187,000	282,000	323,000
7. Air leaving air heater, lb per hr	172,000	265,000	307,000
8. Gas temperature, F:			
a. leaving furnace	1,850	2,035	2,090
b. entering superheater	1,800	1,990	2,030
c. leaving superheater	1,150	1,320	1,355
d. leaving boiler	678	755	770
e. leaving air heater	320	350	365
9. Air temperature leaving heater, F	650	675	680
10. Feedwater temperature, F	380	405	410
11. Steam generator efficiency, %	80.0	80.0	79.3

so they cascade directly to the l-p closed heater. Drains from this heater normally pump to the deaerator, but may be flashed to the condenser.

Makeup normally enters the cycle at the condenser through a vacuum drag line from the condensate-storage tanks. An emergency makeup line ties into the deaerator. Water level in the deaerator storage tank automatically controls makeup flow. First admission is to the condenser. If the level keeps dropping, a makeup pump cuts into service delivering into the deaerator.

Excess water in the system resulting from load pickup or evaporator operation leaves the cycle between the air-ejector condenser and the l-p feedwater heater.

Vapor from the evaporator, designed for continuous operation, condenses in the deaerator. Drips from the h-p closed heater scrub the vapor as it passes through the evaporator steam dome, preventing carryover. A backpressure valve in the vapor line maintains a predetermined pressure in the evaporator during rapid load changes. This prevents flashing in the evaporator shell and high vapor velocities in the discharge line, which cause carryover.

A minimum of interconnections between incompletely treated makeup and the feedwater system guard against condensate contamination. No emergency raw-water lines connect with the condensate system. Conductivity records are made of: condensate leaving the condensate pumps, evaporator vapor output, and saturated steam entering the superheater inlet.

Water Supply. In North Dakota, away from major rivers, water supply presents a serious problem for central-station operation. While there seemed to be adequate subsurface water at the Neal site, it was decided to design the station to use as little water as possible. Fortunately, the potential water supply exceeds that originally contemplated.

Two gravel-packed deepwells supply the plant. The well diameter is 42 in., and the casing diameter, 16 in. This type well prevents excessive water velocities in the sand strata during excessive drawdown. The two wells were designed to produce a total of 1000 gpm, compared to station need of 250 gpm. To date, the water supply has been adequate enough to pump the wells at 1000 gpm.

A cold lime softener reduces well-water hardness from 220 to 100 ppm. Sulfuric-acid treatment reduces alkalinity of the effluent. After this, boiler makeup water goes through a sodium-zeolite unit for removal of noncarbonate hardness before entering the evaporator-feed heater.

The other part of the reduced-alkalinity water serves as cooling water about the plant. After leaving heat exchangers and bearing-cooling coils the water serves as makeup for the cooling tower. The year-round temperature of 40 to 45 F makes this once-through cooling system possible.

Cooling-tower blowdown furnishes water for the ash-handling system. Blowdown from boilers and evaporators is the only water going to waste. Evaporator brine maintained at maximum allowable concentration by automatic conductivity measurement minimizes the blowdown. Exchangers recover heat in the evaporator blowdown circuit. No heat recovery is made from the small amount of boiler blowdown.

Ash System. Water-type vacuum producers activate the ash system. Water to the ejectors returns to a sump for recirculation. The ash, handled dry, collects in a steel silo. The only water in contact with the ash is that used in the dustless unloader of the silo. Before going to waste, major part of water from the wells is used three times: (1) bearing cooling (2) cooling tower (3) ash handling.

Turbine Generators. In sizing boilers, condensers and auxiliaries it was contemplated that the two 15,000-kw turbines would carry gross station peaks of 45,000 kw. A maximum capability test with full extraction on Unit No. 1 developed an output of 22,250 kw with throttle pressure of 775 psia. Manufacturer's engineers calculated the turbine would carry 24,500 kw at rated pressure. To enable the turbine to carry this load, specifications required that the first-stage nozzles pass at least 212,000-lb-per-hr steam.

The plant may run on either header or unit-system basis. There are cross connections at (1) boiler feed suction (2) boiler feed discharge (3) last closed heater and boiler. The plant may run on unit system during sustained heavy load periods or when coal is of poor quality. It may run on header system, two turbines on one boiler during peaking periods with one boiler out of service.

Steam Generators. The two boilers have a continuous rating of 230,000 lb per hr, and a 2-hr rating of 260,000 lb per hr when burning lignite of this type:

Moisture	39.0%
Volatile matter	25.4%
Fixed carbon	29.0%
Ash	6.6%
Grindability (hardgrove)	48
Heating value, 6600 Btu per lb	

Boilers and auxiliaries were conservatively designed because of the uncertainties and difficulties in burning pulverized lignite. Fans are somewhat larger than usual because of high fuel moisture. Both forced- and induced-

Principal Power Plant Equipment

Wm J Neal Station—Units No. 1 and 2, Central Power Electric Cooperative, N.D.

STEAM-GENERATING EQUIPMENT:

Boilers, 2 ..... Combustion Engineering-Superheater, Inc
230,000 lb per hr continuous, 260,000 lb per hr for 2 hr, 905 F superheater outlet at 865 psig, spray desuperheating between primary and secondary superheaters, 13,610 sq ft waterwall surface, 9615 sq ft boiler surface, 6600 sq ft superheater surface, 17,200 cu ft furnace volume
Air preheaters, 2 ..... Combustion Engineering-Superheater, Inc
Tubular, 58,400 sq ft, two sections: 1st 42 ft long, 2nd (cold) 12 ft long
Pulverizers, 6 ..... Combustion Engineering-Superheater, Inc
3 mills per boiler feeding 6 burners, 20,000 lb per hr lignite each
Induced-draft fans, 2 ..... American Blower Corp
165,500 cfm at 13.25 in. wg, 365 F, 795 rpm, double inlet, inlet dampers, hydraulic coupling
I-d fan drives, 2 motors ..... Electric Machinery Manufacturing Co
Forced-draft fans, 2 ..... American Blower Corp
91,700 cfm at 10.23 in. wg, 100 F, 1012 rpm, single inlet, inlet dampers, hydraulic coupling
F-d fan drive, 2 motors ..... Electric Machinery Manufacturing Co
Dust collectors, 2 ..... Western Precipitation Corp
Mechanical, 3 sections in parallel, 86.7% effy at 260,000 lb per hr steam flow
Soot blowers..... Copes-Vulcan Div, Continental Foundry & Machine Co
Per boiler: 2 retractable blowers in screen tubes, 10 stationary blowers; steam blowing, air-operated retractable-manual control
Water columns ..... Diamond Power Specialty Corp
Safety valves ..... Manning, Maxwell & Moore, Inc
Lignite handling ..... Link-Belt Co
200 tph, 2 track hoppers, 4 reciprocating feeders, 1 crusher, 1 apron conveyor, 3 belt conveyors, 2 capstan car pullers, 1 car shaker

POWER-GENERATING EQUIPMENT:

Turbine-generators, 2 ..... General Electric Co
15,000-kw rating, 22,500-kw capability, 3600 rpm, 850 psig, 900 F, 1.5 in. Hg backpressure, 13,800 v, 785 amp, wye connected
Condensers, 2 ..... Westinghouse Electric Corp
13,000 sq ft, horizontal, 2 pass, non-divided waterbox, arsenical admiralty tubes, Muntz metal tube sheets, 300-gal deaerating hotwell
Circulating-water pumps, 3 ..... Westinghouse Electric Corp
17,000 gpm, 490 rpm, horizontal, double suction, single stage, centrifugal
Air ejectors, 2 ..... Westinghouse Electric Corp
Two-stage twin steam air ejectors, one hogging jet discharges to atmosphere
Circulating-water piping ..... A O Smith Corp
¾-in. steel plate, butt welded, coated inside with bitumastic and outside with bitumastic and wrapped
Cooling tower ..... Marley Co
Induced, mortis locked, nail-less wooden fill, open top, steel pipe headers, porcelain nozzles, 12 cells, 6 fans—high speed: 543,000 cfm, 0.24 in. wg, 1800 rpm; low speed: 271,500 cfm, 0.06 in. wg, 900 rpm; reverse 900 rpm, aluminum blades, 34,000 gpm capacity from 99 F to 82 F with 68-F wet bulb
Turbine-oil filtration ..... Wm W Nugent & Co, Inc
Gravity filter and precipitation tank

FEEDWATER EQUIPMENT:

Condensate pumps, 4 ..... Westinghouse Electric Corp
350 gpm, horizontal, 3 stage, centrifugal, 1760 rpm
Feedwater heaters, 6 ..... Griscom-Russell Co
Horizontal U-tube, closed; two No. 1, l-p; 4 pass, internal air baffle for subatmospheric operation; two No. 3, h-p; 2 pass with integral drain cooler; two No. 4, h-p; 2 pass with desuperheating sections
Deaerating heaters, 2 ..... Cochrane Corp
Tray type, stainless steel, vent ejector for subatmospheric operation
Evaporator feed heater, 2 ..... Swartwout Co
11,000 lb per hr capacity, deaerating type, cast-iron trays
Evaporators, 2 ..... American Locomotive Co
6000 lb per hr, 49 sq ft vapor release surface, 142 sq ft heating surface
Evaporator-blowdown heat exchanger, 2..... American Locomotive Co
Boiler feed pumps, 3 ..... Pacific Pumps, Inc
230,000 lb per hr, 1110 psig discharge at 281 F, 1270-psig shutoff head, 3550 rpm, 6-stage barrel type, 11-13% chrome impeller, forced lubrication
Feed-pump drives, 3 motors ..... Electric Machinery Manufacturing Corp
Evaporator-feed pumps, 2..... Peerless Div, Food Machinery Corp
75 gpm at 220 F, 180 ft discharge head
Primary water treatment ..... Graver Water Conditioning Co
Rapid-flow type cold-process softener, automatic feed of dry unslaked lime, sodium aluminate and sulfuric acid after treatment. Automatic blowdown, 570 gpm, hardness reduction 220 ppm to 100 ppm
Zeolite water treatment, 2 ..... Hungerford & Terry Inc
Non-siliceous sodium zeolite, 220-kilograms capacity per unit, 50-gpm softening rate, maximum pH 8.5
Chemical feed pumps ..... Milton Roy Co
Two phosphate pumps, six 60 gph at 925 psig. Two sulfite pumps, 0.15-1.5 gph at 100 psig
Cooling tower chlorination ..... Everson Manufacturing Corp
Capacity of 1000 lb chlorine per day

MISCELLANEOUS EQUIPMENT:

House service compressor, 1..... Pennsylvania Pump & Compressor Co
310-cfm free air at 70 F, 300 rpm, single stage, double acting
Combustion-control compressor, 1 ..... Gardner-Denver Co
123-cfm free air at 70 F, 325 rpm, single stage, double acting, non-lubricated cylinder, solid carbon piston, carbon ring packing
Liquid-level controls ..... Fisher Governor Co
Controls for all heaters, makeup pumps, service water tanks
Combustion control system ..... Hagan Corp
Feedwater control system ..... Hagan Corp
Sump pumps, 2 ..... Economy Pump Sales & Service
House-service pumps, 3 ..... Peerless Pump Div, Food Machinery & Chemical Corp
300 gpm at 70 F, 130-ft discharge head
Makeup pumps, 2 .....
100 gpm at 120 F, 200-ft discharge head
Ash water-booster pumps, 2 .....
60 gpm at 85 F, 275-ft discharge head
Circulating-water booster pumps, 2 ..... Ingersoll-Rand Corp
220 gpm at 80 F, 100 ft discharge head
Ignition oil pumps, 2 ..... Worthington Corp
15 gpm, No. 2 oil, 5-80 F, 237 ft discharge head, 10-ft suction lift, 1750-rpm double helical gear
Fire pump, 1 ..... Allis-Chalmers Manufacturing Co
1000 gpm, 125-psig discharge
Turbine-room crane, 60 ton, 1 hook ..... Whiting Corp
Ventilating and air-conditioning systems ..... Sornsin Co
Main control room air conditioned, general offices, locker room and electrical control room ventilated
Truck scale, 30 ton ..... Buffalo Scale Co
Steel tanks, 8 ..... Wm Bros Boiler & Mfg Co
Ignition-oil storage, 2 condensate storage, service water, boiler blowdown, flash, lime storage, ash storage
Lime-handling system ..... Link-Belt Co
Bucket conveyor, 20 tph capacity

ELECTRICAL EQUIPMENT:

Transformers, 4 ..... Westinghouse Electric Corp
Outdoor, oil immersed, self-cooled with forced-air cooling, two 18,000 kva, 7500 kva, 1750 kva
Outdoor switching structure ..... Delta-Star Electric Co
Supporting steel, disconnect switches and operating mechanisms, protective fuses and fuse holders for potential transformers, buses and connections to equipment, insulators, hardware
Main control boards, switching equipment..... Allis Chalmers Mfg Co
Equipment controls main generators, main exciters, pilot exciters, reserve exciter, auxiliary transformer circuits, outgoing feeders
Indoor motor-control centers ..... Westinghouse Electric Corp
Indoor 440-v auxiliary switching ..... I T E Circuit Breaker Co

CONSULTING ENGINEERS:

Preliminary studies ..... Ulteig Engineering Corp
Design, erection supervision ..... Vern E Alden Co

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draft fans have hydraulic couplings. They also have dampers on the inlets for better low-load control. Automatic control of the dampers varies the openings as a linear function of the steam flow. The i-d fan controls furnace draft, while the f-d fan regulates air flow to the boiler. A safety interlock in the control scheme cuts back fuel feed with insufficient air flow.

Instrumentation. Supervision of the entire plant centers in the air-conditioned control room, with the exception of boiler lighting-off, soot blowing, water plant operation, and coal and ash-handling systems. Normally two men control the plant, a fireman for the boilers and an engineer for the turbines and electrical switchboards. This central control brings large central-station economies to the small plant. The personnel is happy with the compromise between complete centralized control and omission of those portions mentioned that were too expensive to include for remote control.

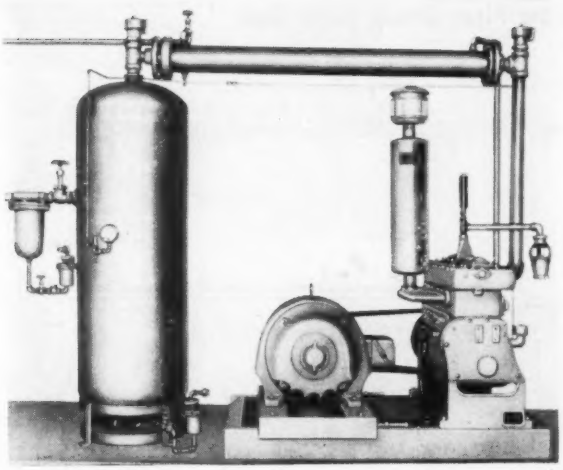
All records for operating efficiency and plant betterment are kept on automatic recorders, relieving operators of endless data taking. We felt this would help each man try to achieve a "better record" than his watchmates.

Fuel Handling. The lignite-handling system has two 12x24-ft track hoppers. One receives rail coal, the other at present takes truck coal. Four reciprocating plate feeders pass the lignite to a 36-in.-wide pan-type apron conveyor. The latter places the coal on a 30-in.-wide rubber belt, which takes the lignite to a breaker. From the breaker the lignite goes to either the plant or the stockpile.

Both track and truck hoppers are heated. This prevents stoppage during extremely cold weather when snow adds considerable surface moisture to the lignite and aggravates the freezing problem that complicates unloading.

Blowers, with a capacity of 12,000 cfm of 250-F air, discharge into the lignite storage bunkers for drying. The discharge pipe runs nearly down to the bunker outlet, to deliver air under 16-in.

(*Continued on page* 208)



1 Packaged compressor is supplied by manufacturer with all the units shown here. Just bolt down and hook up for use

2 Packaged-type compressor is easily moved by the standard materials-handling equipment found in industrial plants

Do Plant Air Systems Need a New Look?

Which is better, a large, centrally located air compressor or several small ones spotted in areas needing air? Here's the answer, as one engineer sees it. Read his concise discussion of pros and cons. See if you agree with him on which is best

By **LESLIE B SCHRAMM**
Secretary, Schramm, Inc

► WHY DO ENGINEERS planning compressed-air distribution systems overlook the close parallel between them and electrical - distribution systems? Over 12 years ago electrical engineers changed their thinking on in-plant distribution, came up with a more economical and efficient system. Yet few mechanical engineers have tried the same principle in their work. Why?

These questions, asked by an electrical engineer of long experience, prompted this study of compressed-air distribution. Let's see if the unit system of air distribution has the same advantages as load-center electrical distribution.

Similarities. As far as distribution is involved, air and electricity are similar in these respects: voltage and air pressure, kva and cfm, voltage drop and pressure drop. In other words, problems of distribution are parallel.

Advantages. Long use of load-center distribution of electricity shows it is better in many respects than the older method having a single substation and long secondary feeders. Important advantages are: lower first cost, less voltage drop, reduced engineering and planning, easier purchasing, less expensive financing for expansion, simpler installation, high salvage value of equipment and greater flexibility.

Let's take these advantages one by one and see if they apply to the unit system of compressed-air distribution. Fig. 3, 4, 5 and 6, pp 76, 77, show how the old and new air and electrical systems stack up with respect to run length, number of runs and substation or compressor size.

First cost. Cable runs in load-center systems are short, meaning low cost. In a similar air system, pipe runs are short too, Fig. 4. Transformer cost (comparable to air-compressor cost) may be slightly higher, but net result in an electrical system is a total cost of about 87% for the new as compared with the old. General saving for a load-center system is 10 to 30%; for unit air systems it is comparable.

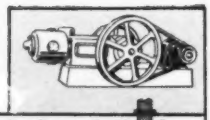
Big savings come in compressor and auxiliary-equipment installation. Central systems have one or more large compressors connected to plant with relatively long runs of large pipe, Fig. 3. Unit system has a number of small lightweight compressors with short runs of small pipe.

Large compressors need costly foundations going down to bedrock. Foundation mass must equal weight of compressor, motor and other installed equipment. Erection labor, from factory, is needed. Wages, expenses and traveling costs are all added to compressor purchase price.

Vertical or V-compressors for unit systems are packaged type, need no foundation other than a substantial floor that will carry weight of compressor and accessories. You don't need erection crews because the units are engineered to be installed by regular maintenance personnel.

Table, p 77, summarizes initial costs

Central-System Pipes Are Large, Runs Long. Unit-System Pipes Small, Runs Short



of the two types of air systems for a plant using 1000 cfm at 100 psi. On a typical job this air is needed in four areas: 300 cfm in assembly room, 300 cfm in sandblast and paint, 200 cfm in testing, 100 cfm in shipping—and 100 cfm for day maintenance work.

Looking over the table you see that the typical unit system has lower initial cost. And there are other advantages —detailed below.

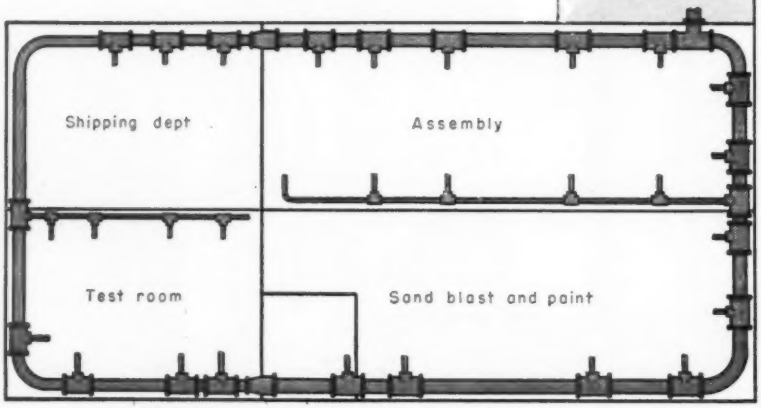
Less Pressure Drop. Load centers use small wires, high voltage for power transmission to substations. Since compressors in the unit system are close to the load, small pipes with short runs transmit air with low pressure loss.

Pressure drop in air lines is a function of pipe length, diameter, air quantity handled, inlet pressure, and pipe restrictions like bends, valves and other fittings. Short runs with few bends and fittings have low pressure loss.

Feeding air outlets radially from a compressor in the department area permits sizing pipe for air quantity needed at the outlets. Pipe can be run and compressor located so there's minimum pressure loss. Tools and other air-operated equipment perform better with less power waste, pressure drop being power loss.

Less Engineering. With load-center equipment, factory-engineered packages serve as substations. All that is needed is a flat mounting surface, and leads to and from substation.

Likewise, in unit system for air distribution, most compressor builders can now supply units from fractional to 150 hp. Relatively little engineering and planning are needed for installation. Among the items not needed for unit systems are specially built compressor rooms with inlet ducts and filters, costly foundations to bedrock to cut vibration, extensive electrical systems, special water pumps and coolers.



3 **CENTRAL-DISTRIBUTION** system has one or more big air compressors to supply air through a loop main that runs to all departments. Main is large, has long run

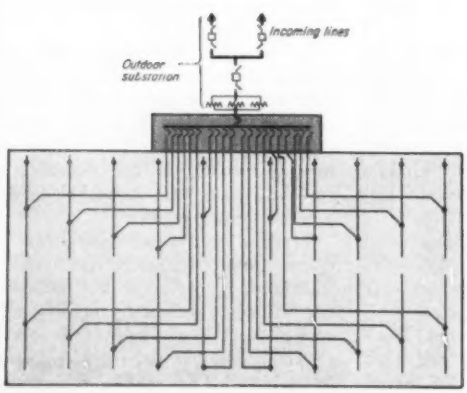
Selection. To pick a packaged unit all you need do is figure compressor capacity required and then find a suitable unit in the manufacturer's catalog. When it arrives compressor is grouted and bolted to present plant floor.

When motor, receiver and other equipment are on hand, only the bare compressor is purchased. If no equipment is on hand the complete installation including motor starter, aftercooler and moisture separator may be purchased. Package includes all necessary parts, hooked up and mounted on a common base and ready to be connected to air and electric lines, Fig. 1. Maintenance crew easily installs unit, saving money.

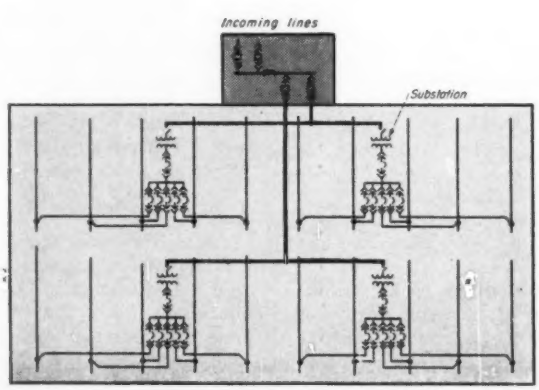
If, at a later date, you ever want to move packaged compressors, this is easy, Fig. 2. Lift trucks or other materials-handling equipment transport compressor.

Purchasing Facts. With distributors throughout the world handling packaged

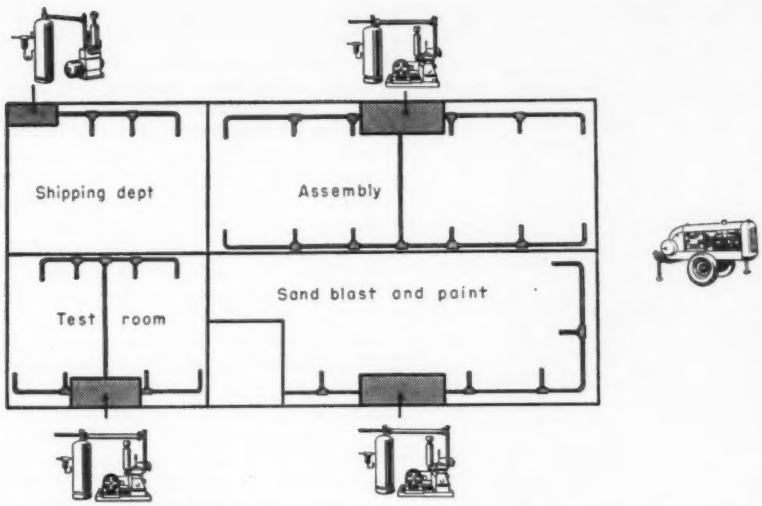
Electrical-Distribution Systems Closely Resemble Those for Compressed Air



5 **OLD-TYPE** electrical distribution system has a single substation with long secondary feeders. The cost is high



6 **NEW-TYPE** electrical distribution system uses load-center packaged transformers, has short run lengths, low costs



4 **UNIT-DISTRIBUTION** system has one or more packaged compressors spotted in plant areas using air. Mains are small, runs short. Portable is for maintenance

units, you can quickly and easily obtain units from fractional through 150 hp. Where you must increase compressor capacity in a hurry, you can find one of these units in a matter of hours, instead of months needed for custom-built jobs. And the price quoted is what you pay, except for the small additional cost of grout and piping.

Financing. Load centers for electrical distribution grow with the plant, more units being added as demand increases. The same is true of unit system for air distribution.

Many older plants outgrow their original compressor installation. To expand: (1) A larger centrally located compressor may be ordered. (2) Other large-capacity units may be installed with existing units. (3) Or package units may be scattered in areas needing more air. Most plants now choose method 3 for reasons we've already given.

Another important reason for using package units is that it is easier to sell plant management on small expenditures for package compressors than on complete replacement or capacity sufficient to handle unknown future growth. It's more sensible, from a management standpoint to add needed capacity in small segments than to add large capacity for some future dream.

Comparison of Unit and Central Distribution Systems

Unit System		Central System	
Compressors[1]		*Compressor*[2]	
Two 315-cfm stationary	$12,476	One 1061-cfm stationary	$18,872
One 210-cfm stationary	3,840		
One 105-cfm stationary	2,529		
One 105-cfm portable	3,370		
Foundations		*Foundation*	
Total for all stationary units listed above	100	15 cu yd @ $65.00 per yd excavated, formed, poured	975
Erection		*Erection*	
Total for all stationary units listed above	240	10 days' work for four men @ $30 per day per man	1,200
Piping		*Piping*	
2-in. mains and 1-in feeders	600	6- and 4-in. mains with 1-in. feeders	6,000
Total	$23,155	Total	$27,047

[1]Includes compressor, motor, aftercooler, moisture separator, traps, air receiver, motor starter and air-receiver fittings for each installation.

[2]Includes compressor, synchronous motor, exciter, motor-generator for exciter, motor starter, aftercooler, moisture separator, trap, air receiver and fittings.

An excellent example of this occurred during World War II. Starting with only a bank of machine tools and one 105-cfm compressor early in the war, an aircraft-parts manufacturer saw his load grow to where he needed seventeen 105-cfm compressors. After the war when business slacked off he shut down sections of his plant in the same way he had increased their capacity. When his business was almost completely gone, and while looking for other items to produce, he sold most of his machine tools and compressors. The latter sold quickly because moving them to another plant was extremely easy.

Had this manufacturer tried to install a single compressor at the start to take care of his maximum needs, he might not have been able to finance it. Also, he'd have a white elephant on his hands when business slacked. This is not an isolated case; other manufacturers use the same plan.

Think of unit compressors as "building blocks" added to plant as air needs increase. This avoids investment for compressors larger than needed at the moment.

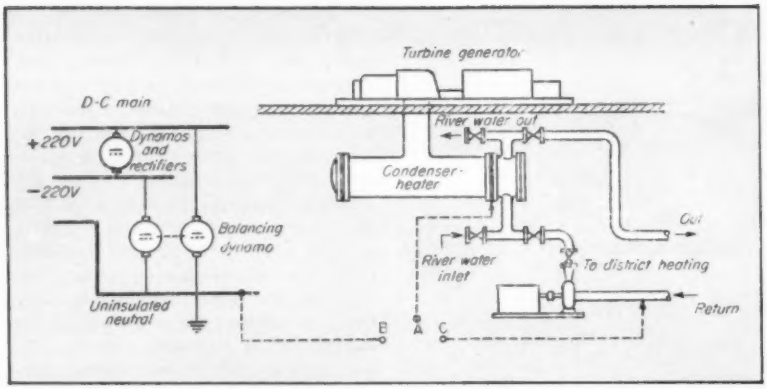
Salvage Value. Electrical-equipment manufacturers realized the importance of equipment that could be used over again when introducing load-center systems. High salvage value is important where plant expansion or contraction is easily affected by war, business cycles, market changes, inflation, etc.

Unit system of air distribution has same high salvage value. This is both outside the plant, as with the aircraft-parts manufacturer, and within the plant where demands may change. Inside a plant you can easily shift a compressor from one department to another at low cost. Frequently, portable compressors may be used to supplement installed capacity during peak loads.

Portables have become an important part of unit systems in many plants. They prevent maintenance crews from "robbing" air from production lines while doing work during the day. Portable close to job eliminates costly piping or hose runs, doesn't affect shop-line or maintenance-tool pressure. These compressors have saved many engineers a costly shutdown. In some plants, banks of portables have been rented to keep a shop going while repairs were made to a large central-system compressor.

Portables are now available as self-propelled (tractor-compressor) units that provide maintenance department with an air compressor and tractor. A few of the devices you can hook to tractor include snowplows, winches, booms,

(*Continued on page* 210)



1 During winter season condenser acts as heat exchanger to produce hot water for district heating. In summer it functions as condenser using circulating water

How We Cured Condenser Tube Corrosion

Sudden tube leakage on a special heater-condenser demanded quick solution to avert catastrophe. Here is an account of how some simple methods pinned down trouble and controlled it

By H WELDINGH, *Odense Lighting Dept, Denmark*

► A NEW 3500-kw steam turbine started in January 1947 at the Odense Power Station. This plant supplies both electric energy and hot water to a district heating system. Turbine discharges to a special condenser with 5400 sq ft heating surface. Steel tube plates hold aluminum-brass tubes (77% Cu, 20.2% Zn, 2.7% Al) in metallic packings.

During the heating season the condenser cooling water circulates through the district heating system. Circulating water passes through the condenser at the rate of 1,400,000 lb per hr under a pressure of 70 psig. Condensing steam raises water temperature from 122 to 175 F. The vacuum, naturally, is quite low.

During the summer, the turbine runs as an ordinary condensing unit, using river water for cooling in the condenser. This requires two sets of circulating-water connections, one for the river water and the other for the district heating system. At full condensing the turbine develops 4000 kw, but its steam rate is poorer than other units in the station—hence during the summer it is used mostly for standby.

Trouble. In the summer of 1949, condenser tubes started leaking, and 113 had to be renewed. These were 5% of the total 2250 tubes. Chemical analyses and microscopic examination showed the material was good, Fig. 3.

The corrosion involved zinc removal from the alloy. A thin scale coated the tube interiors, caused by sewage pollution of the river water. The zinc removal might have been caused by (1) the scale (2) district-heating water (3) stray-current electrolysis.

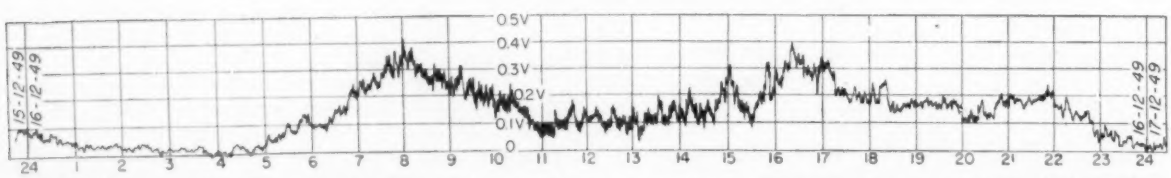
Electrolysis. A 2-wire 220-v dc system supplies the central part of Odense. In addition, a 500-v dc system feeds the tramway. Uninsulated copper cables serve as neutrals for the dc grid and feeders. In the station, the neutrals are grounded, while feeders to the tramway are insulated and not grounded. Fig. 1 shows, schematically, the 500-v system and the turbine installation.

The district-heating system consists of six miles of 16-in. mains. Feeder and return pipes lie side by side in a tunnel of reinforced concrete. "Cellular" concrete fills the space between pipe and tunnel walls. Since the tunnel is not quite waterproof, it is placed above ground-water level.

Measuring voltage drop between certain points in the power station started the search for possible electrolytic corrosion cause. Measuring points included outgoing and return heating pipes, cooling-water pipes, backpressure turbine, condenser, other turbines, boilers, steam and water pipes, water tanks. The portable millivoltmeter showed some of these points were negative and some positive, relative to the dc neutrals and tramway systems.

Readings were taken with (1) turbine-condenser heating circulating water for distribution (2) turbine-condenser using river water (3) turbine out of commission and district-heating pipes disconnected. These showed potential differences (pd) at all points, (1) and (2) in particular had the highest pd with one exception, a water pipe in the ash cellar. Apart from the latter, the pds were all less than 200 millivolts.

On the district-heating pipes there



2 Electrical potential difference between condenser tube plate and station dc neutral cable varied throughout the day exactly the same as the electrical load. Voltage drop reached a maximum during peak loads in morning and afternoon

was a noticeable pd in a direction toward the condenser. This was greatest when the condenser was disconnected from the district-heating pipes. It was found that the current in the dc neutrals was always into the station. A part of this current left the bare neutrals and strayed through the ground to the district-heating pipes and through these to the condenser tubes. This stray current also flowed into the river water, through the ground to the station grounding electrode.

Analysis. These data suggested the reason for the sudden tube corrosion during the fall of 1949. During the summer of 1949 the turbine ran for many hours, with river water flowing through the condenser aggravating the condition. The running hours exceeded those for the two preceding summers combined.

In Fig. 1, *A*, *B* and *C* are the pd measuring points. *A* is about 100 yards from *C*. The pds in millivolts for the three operating conditions were:

	A-B	*A-C*
(1) Heating operation	100	38
(2) Condensing operation	100	35
(3) Disconnected pipes	—	95

We measured the voltage variation for several days from *A* to *B* with a recording millivoltmeter. Records were made with the turbine in service for heating and condensing generation. In both cases the voltage drop varied in the same pattern. Fig. 2 shows that the pd varies almost proportionally with the dc load. It's a maximum of 0.4 volts at 8 am and 4 pm. The lowest values occur from midnight to 5 am.

Cure. The condenser tubes were constantly acting as an anode, hence, became badly corroded. The remedy was to provide a path for these currents around the condenser to the dc neutral. We did this in 1950 by connecting the condenser tube plate to the dc neutral with a copper bar 60 ft long, having a cross section 30x5 sq mm and a resistance of 0.002 ohm. A 0.0002-ohm shunt in the bar permitted taking ammeter readings of current flow. Ammeter readings have been taken at different hours of the day for the last couple years. Current in the bar has always been from the condenser plate to the neutral. The minimum current was zero and the maximum 85 amp. Normally it varies from 25 to 50 amp throughout a day.

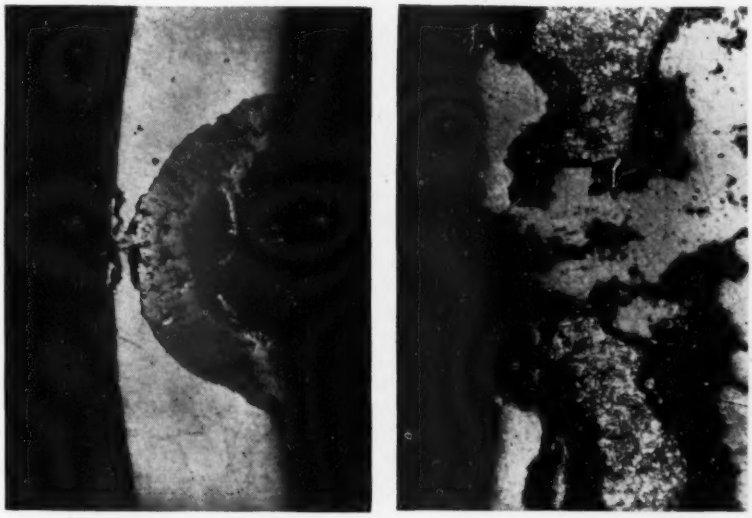
Since this connection was installed, there has not been a single failure in a condenser tube, even though the tubes were badly corroded at the time connection was made and the turbine running for a high number of hours during the summer.

Fig. 4 shows microphotographs of a tube section installed in the condenser in the summer of 1949. It was examined in 1950. This tube had only 6 months' service before the copper bar connection was made. Although it had not failed at time of removal from condenser, the corrosion has penetrated about two-thirds of the wall thickness. Zinc removal is involved in this corrosion too.

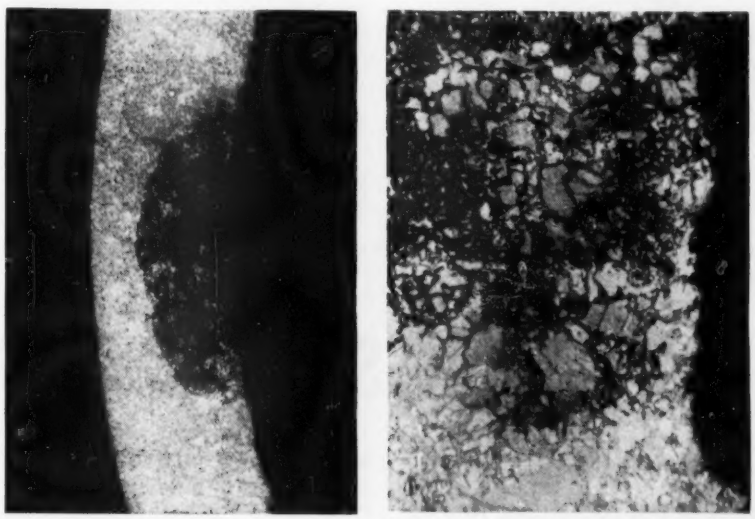
We expect the tube corrosion will continue despite the electrical connection. The deterioration rate, however, will be very much slower, and chemical in nature rather than electrical. Since no further tube failures have occurred, it would seem that condenser conditions are now under control to the maximum possible extent.

Without the electrical bus, it would have been necessary to replace all condenser tubes in a very short time. The prospective life of the replacement tubes would have been much too short.

Microphotographs Gave Clue to Cause of Corrosion Trouble

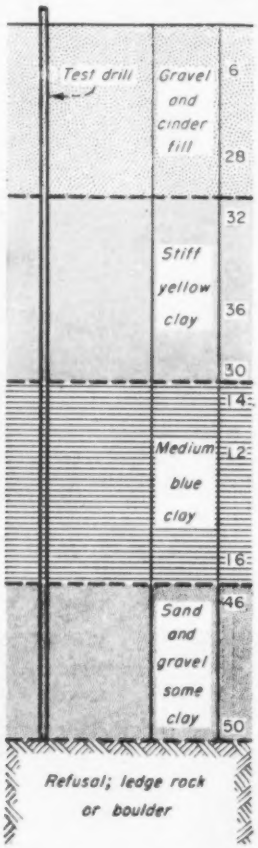


3 Microphotographs of corroded tube at 24x and 180x enlargement showed the trouble was zinc removal from alloy. Tubes had thin scale coating on interior

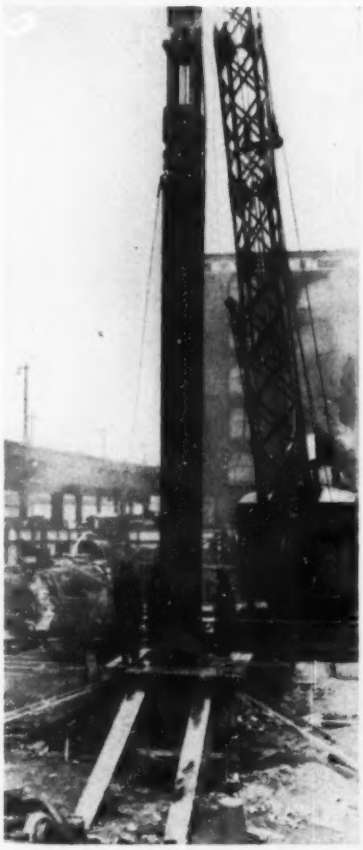


4 Microphotographs of partly corroded tube at 24x and 180x enlargement after installation of electrical bypass showed the rate of wasting was greatly reduced

Soil's Load-Bearing Ability Is Checked Prior to Driving Piles for Turbine



TEST BORING before pile driving. Figures to right show blows needed to drive 1 ft



PIPE PILE being driven as part of the foundation for a 50,000-kw extension

AFTER DRIVING pipe shell to full depth compressed air handles final cleanout

Structural Support for Plant Loads

- **Briefing on fundamentals of concreting, equipment foundations, plant structures**
- **How piles and spread footings support heavy loads**
- **Problems that may crop up when conduit is laid in concrete during construction**

By **A G HULT**, *Structural Engineer*
Burns and Roe Inc

► TODAY'S POWER-PLANT BUILDING is designed primarily to support and enclose turbine - generators, switchgear boilers and fuel-handling equipment. Grouping such equipment into a relatively small plant area always means a highly concentrated weight for the foundation. Average unit load on the soil beneath a typical modern plant falls somewhere between 3000 and 4000 psi. These pressures are higher directly under the boilers, turbines and coal bunkers. Since concrete is a common material for foundations and general building construction, let us first consider its makeup and how it is used.

CONCRETE

Concrete is cement, sand, stone and water, mixed together and allowed to harden. To get concrete of a specified strength, care must be taken in selecting each of the materials, including the water, and then proportioning the mix.

Gravel and sand form a mass of loose particles of various sizes. Then cement is added to coat each bit of sand and stone. Water is introduced to hydrate the cement, causing the bits of sand and gravel to adhere to each other. This in a nutshell is concrete.

Concrete Specs. Concrete is frequently specified by either of two ways: a volume mix ratio or the desired strength. In specifying a mix by volume ratios, such as 1-2-4 or 1-3-5, we mean one part cement or two parts sand to four parts of gravel. More often the specification calls for concrete to be of certain minimum ultimate strength, say 2000, 3000, or 4000 psi at the end of 28 days.

When mixing concrete remember the

And Building Supports

STEEL CORE is then lowered into shell for transmitting load to the rock bed

less water used the stronger the concrete. And after pouring the concrete, the more water you use in keeping it wet, the stronger it will be. Concrete may be kept from drying out too fast by using waterproof paper coverings or water sprays. Specifications often limit the water per bag of cement to about 6 gal, for 3000 lb concrete.

About 2½ gal of water is needed to hydrate one bag of cement fully, if thoroughly mixed. But additional water is added to make concrete easier to mix and place. Added water increases *slump*, a measure of fluidity of a given mix. The greater the slump, the more fluid a mix becomes and the easier it is to place. So an irresponsible contractor is apt to use lots of water. A better way to increase slump is to add both cement and water to keep water-cement ratio constant.

Concrete Tests. To make sure concrete is of proper strength, samples are taken as it is being placed. Records are kept of where it was placed, noting the time and weather. Samples are sent to a testing laboratory. One sample of a "set" is tested at the end of seven days and another at the end of 28 days. The 7-day test is considered an indication of what to expect from the 28-day test, which is the one that must come up to specified strength. Portland cement concrete will develop about two-thirds of its design strength in the first seven days and its full design strength in 28 days. Good concrete will keep growing stronger throughout its life.

Don't pour concrete in cold weather, without protection. It freezes easily and, when frozen, hydration completely stops, so, as a result, you may have only an uncemented mass of stone and sand.

Concrete is an excellent structural material in compression, but weak in tension. So to take tension in beams, slabs, footings, and so on, steel rods are used to reinforce it. It is assumed for design purposes that all tension is taken by the steel rods used as reinforcing.

CONDUIT

When conduit is run in concrete, keep it at least four inches from the surface. Reason is that localized heating of conduit may break the bond between it and concrete. I feel the only time conduit should be run in concrete inside a building is when there is no other way to run it. When going through floor slabs and concrete walls, use pipe sleeves larger than the conduits. Heating of bare grounding cable or conduit laid near concrete surface will result in concrete spalling. Thus the bond between cable or conduit and concrete will be broken.

When conduits must be placed in a floor slab put an additional slab atop the structural slab. This is most feasible where we have small floor areas and many conduits. It wouldn't be practical to do over a large floor area just to take a few conduits. An alternative would be conduit sleeves in the slab, then inserts in underside of slab to hang conduits. Below the basement floor, conduits may be laid directly on top of the fill and basement-floor slabs poured right over them.

Grounding. Pumps, motors, pipes, conduits and other mechanical and electrical equipment may be grounded to the building steel framework. All steel, in turn, is tied to the ground mesh or mat. More positive protection results from using a grounding cable for the complete column length. Then ground connections from this cable tie into the ground mesh.

In laying a ground mesh, one method is to lay cable directly on the ground right below the basement floor slab, stringing it along under the column lines. Then a ground lead is brazed to each column, tied to the column grounding-cable, through the floor slab and to the ground mesh. This mesh is then tied at intervals to pipes or ground rods driven 20 ft apart, 8 to 10 ft deep.

EQUIPMENT FOUNDATIONS

Within the plant building, concrete is used mostly for building foundations, equipment foundations and floor slabs. It makes an excellent equipment foundation because of its strength and weight. Its weight, when properly used, tends to dampen the vibration of moving equipment such as turbines, compressors, pumps, motors.

A safe rule to follow in the design of most equipment foundations is that the weight of foundation should be two to three times the total weight of machine, or three to four times the weight of moving parts. Foundation is usually a little larger than the machine bed and minimum depth is determined by weight requirements. Machine foundation is generally tied into the building slab or mat supporting it. An exception is made for large equipment like turbine-generators and pulverizers.

Here are a few design rules of thumb for turbine-generator foundations. Depth of every member, vertical or horizontal, is about one-third the length of span. Sometimes you can cut this to one-fourth the span length by using structural steel beams for reinforcing. So for an 18-ft span between bents, you should have about a 6-ft-deep beam; width about one-half to two-thirds beam depth.

Don't make square-corner intersections. Use a 12-inch or larger haunch. And for appearance, chamfer all corners.

Soil Loads. Almost any soil will take a spread load of 500 to 1000 psf. And if the soil is dry with much sand and gravel, or even dry clay, it will probably be good for 5000 or 6000 psf, or more. About 3000 to 4000 lb is a safe guess for average soils.

But a guess wouldn't do for a major structure. Soil investigations are almost always necessary. Adequate soil study and proper foundation design is of top importance.

Test Methods. There are two general methods of soil investigation: visual inspection and test loading. Visual inspection calls for digging a test pit to required depth, then studying the soil. This is OK for shallow foundations and light loads.

But with deeper foundations and heavy loads, core borings are always desirable. In this test a small pipe is driven into the ground. Inside the pipe a spoon lifts the material out as the

outer shell is driven. Samples of earth strata are brought up as the boring goes deeper.

Record is kept of the number of blows per foot needed to drive both shell and spoon. These data, plus samples, give a fair insight to type of material in various strata and their approximate load-carrying capacity. If standard pipe shells, spoon sizes and driving-hammer weights are used, a core boring gives both visual inspection and test load information.

Surface-test loads are frequently used with test pits. In this test a pit is excavated to a footing depth and load applied on a small area, usually 4 sq ft. Accurate settlement records are kept. Method of loading, increments of applied load and allowable settlements for given design loads are included in most building codes.

Another load test consists in driving and testing actual piles. Type pile used is generally the same as planned for the final installation. After driving these piles to the depth wanted, or to depth corresponding to a given number of blows per foot of depth, a platform is built on top of pile and test load applied. Measurements of settlement are taken as load is applied. Building codes are explicit as to load increments and permissible settlement for a given design load per pile.

BUILDING FOUNDATIONS

There are two general types of foundation substructures: pile and spread. A pile foundation uses a post or series of posts extending into the ground. Here the higher bearing capacities of deeper soils are used rather than the weak surface stratum. There are many kinds of piles. They vary as to (1) how they pick up their load capacity (2) what material they're made of.

Piles may be friction or end-bearing. Frictional pile gets its load carrying capacity by friction against soil it is driven through. Its rated load is a function of resistance to driving. An empirical formula is used to determine this load capacity. Load equals a factor times pile penetration per blow of pile driver. An end-bearing pile is driven down until it hits against bed rock or some stratum solid enough to carry desired load.

Type Piles. Wood piles are generally the friction type. Precase concrete may be used as either a friction or end-bearing pile. Such piles are made up in advance to required length, then driven till they reach a specified resistance for weight and type of pile hammer used. Piles may be square, hexagonal or octagonal. They generally have reinforcing rods within them to prevent shattering from the driving blows. Their tips are heavily reinforced to prevent crushing.

Then there is the pile in the form of a thin, tapered, corrugated-steel shell, driven with a mandrel. It is filled with concrete after driving. This pile is designed to pick up friction-bearing more rapidly than a timber or precast concrete pile. And it can also be used as an end bearing pile.

There are several variations of the thin-steel-shell piles. One is called a button-nose pile. The button is a precast concrete tip with a conical point. It has a lip at the top over which a heavy pipe sits. This heavy pipe drives the button, the pile driver hitting top of the pipe. After driving, a thin steel shell is dropped within the pipe, filled with concrete, and the driving shell pulled out.

The pipe pile is a popular end-bearing pile capable of supporting heavy loads. This pile is driven open ended to rock, then the dirt blown out by compressed air, and pipe is filled with concrete.

Caisson pile is a variation of the pipe pile. This is essentially a large pipe, sometimes large enough so a man can get into it and shovel his way down to the desired depth. Then it is filled with concrete.

Then there is the steel H-beam pile. It is usually driven through to rock and treated pretty much like a building column in any location. There are variations on all these pile types.

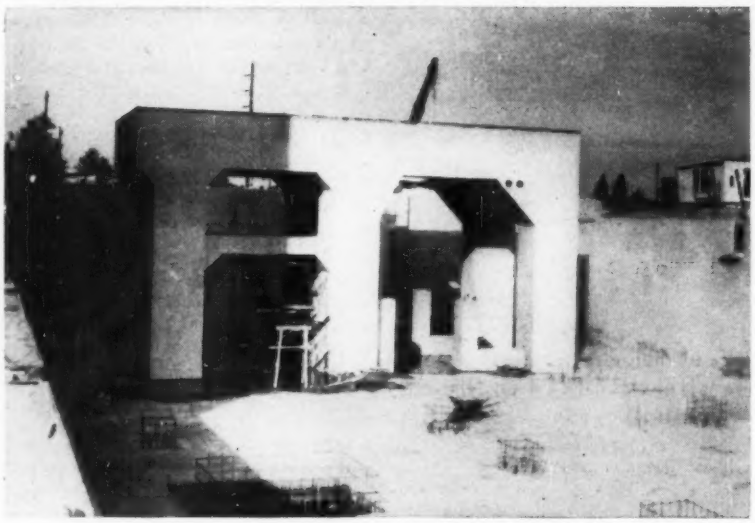
Application. To illustrate application of the modern pile let us look into a recent plant extension. New structure went up between the old plant and the river. It was in a crowded plot and had to be built right over two existing discharge tunnels, one intake tunnel, one coal-conveyor tunnel and one ash-conveyor tunnel. That made five existing tunnels running through the site toward the river and we had to put in two more, an intake and a discharge.

New extension was designed for 50,000 kw with a 660,000-lb-per-hr boiler. Boiler was suspended from building steel at drum level. Building columns supporting front of boiler also had to support a 2500-ton coal bunker. Load on some of those individual columns exceeds one million pounds . . . more than a thousand tons on one column. Building code allowed 60 tons per sq ft bearing on rock. That meant a pile of about 17 sq ft in cross section or better than 5 ft in diameter, which we couldn't put in. So we used a drilled-caisson type pile.

This drilled caisson is a pipe pile with a 24- or 30-in. pipe shell driven to rock. Shell is excavated, then rock drilled below the shell. By drilling into rock at shell bottom, the 60 tons per sq ft bearing value of rock, plus the value in shear between concrete and rock in drilled part, can be used. That shear factor increases the theoretical diameter of bearing area at bottom by twice depth of drilled section.

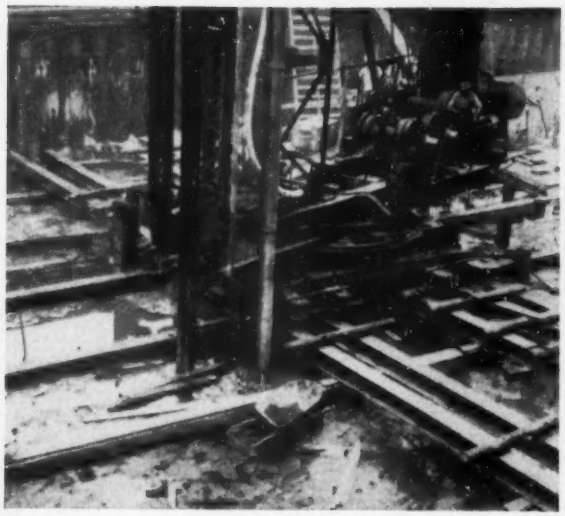
Spread Foundation. This is usually the easiest to design and build. A spread foundation is merely a pad that

A Pile's Job: To Carry the Given Load Through

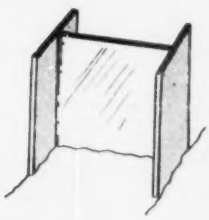


CONCRETE foundations rather than steel are generally used to support turbine. With steel alone it is a more difficult problem to successfully eliminate vibration

Soils Having Poor Bearing Ability to Those Offering Adequate Support

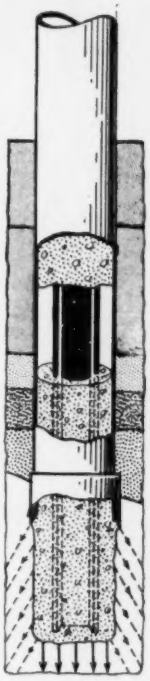


TURBINE AREA before steel skeleton and concrete are set. The step-tapered steel shell piles are being driven into position

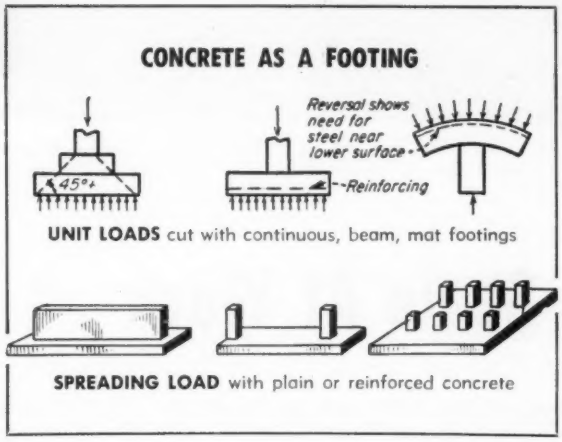


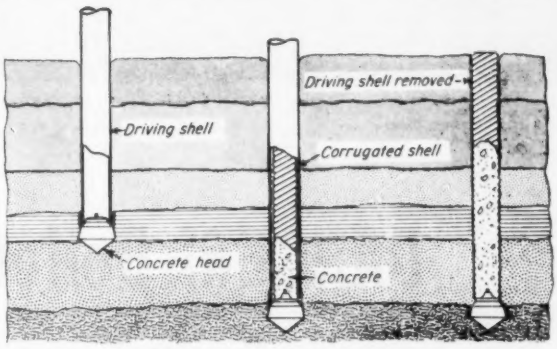
H-PILES stand up well under hard driving. They have been driven to depth over 300 ft

TUBULAR design with tapered lower sections. After driving, tubing is filled with concrete



DRILLED-IN type pile ends in rock socket. Supports heavy loads with minimum-size shell


CONCRETE AS A FOOTING
Reversal shows need for steel near lower surface
45°
Reinforcing
UNIT LOADS cut with continuous, beam, mat footings
SPREADING LOAD with plain or reinforced concrete



PRECAST CONCRETE head on this type pile gives maximum bearing with minimum damage to shell. Concrete fills shell

spreads or distributes a load over a large area to decrease the unit loading on the soil.

For small loads the footing can be of plain or unreinforced concrete. Concrete always breaks along a 45-deg line. Hence a plain footing has to be thick enough so a line from point of load application (top of the footing) to toe of footing makes more than a 45-deg angle with base. As loads get larger and footing areas increase, it becomes impractical to increase depth too much. Next step is to reinforce footing base slab to take bending.

Reinforced footings are thinner than plain concrete footings. They are similar in design to floor slabs. If you turn a footing upside down mentally, their design is easier to visualize. Note from sketch that you approximate a column topped by a slab, which is uniformly loaded by the soil pressure and cantilevers on all four sides. Steel reinforcing is assumed to take all the tension. So it should be in top of slab as drawn or in bottom of footing as actually placed.

The architect looks on a power plant as almost entirely a functional design. Its size and shape is something he has little, if any, control over. Governing factor is size of boiler, turbine and coal-handling equipment. He can dress up the outside by varying size, shape, location of windows, adding or eliminating pilasters, or using different types of materials for exterior walls.

Since the structure itself is really the major non-income-producing part of the power installation, efforts are continually being made to decrease this cost. One means used in recent years is the outdoor installation.

Another approach to this cost problem is to use standard plants. Philosophy behind a standard plant is to have standard equipment layouts and designs for units of various sizes. This equipment is all designed and laid out to go into a minimum of space. By so doing the building volume or cubage necessary for the plant can be cut.

(*Continued on page* 216)

SCALE BUILD-UP, uncontrolled, in a firetube boiler, can lead to bagging and bulging like the extreme case above. Once a bulge like this one lets go, it touches off a violent explosion. Today, proper water treatment tools can positively prevent it

DANGER! Boiler Scale At Work

► MUCH OF YOUR ABILITY to acquire and maintain the best possible internal conditions for your boiler depends on how successful you are in staving off scale formation. First, you need to be familiar with how scale forms, and specifically how it pertains to your particular boiler design and operation. And what is even more important, you must then conscientiously enforce the proper steps to prevent scale formation.

Rarely ever do hit-or-miss schemes produce a satisfying or lasting solution. Nor can slipshod supervision insure favorable results. In fact, the less you leave to mere chance and the more you set up controls over the physical and chemical factors governing scale deposits, the surer you are of preventing scale build-up. But let's get down to cases.

What are these factors? How do they influence scale formation? What effect do they have on boiler operation? What must you do to remove scale? Here are the pertinent answers, whose details will follow in later articles.

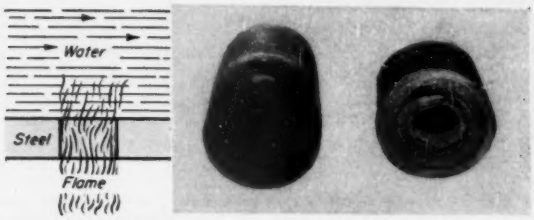
Factors. Hardness bestows the scale-forming property on water. It consists of the calcium and magnesium compounds contained in a water. Except for falling rain, all natural waters possess hardness to some degree. And rain water in making its course over and through the soil absorbs mineral salts to give it hardness. The amount of solids it absorbs depends on (1) chemical composition of the earth's strata in any one particular locale (2) ease with which its constituents are apt to enter into solution. As a rule, the longer water remains in intimate contact with the ground, the more minerals it dissolves. Subterranean waters, therefore, generally carry more dissolved solids than surface waters. Since calcium and magnesium salts are quite soluble, it follows that underground waters usually possess higher hardness content than surface waters.

We can roughly classify mountain streams as having from a little below 10 ppm to 60 ppm of hardness (as $CaCO_3$). Surface supplies fall within a 50-180 ppm range, and well waters from 150 on to nearly 2000 parts. Sea water, having hardnesses that run well up into the thousands, is ruled out as not feasible for boiler feedwater use.

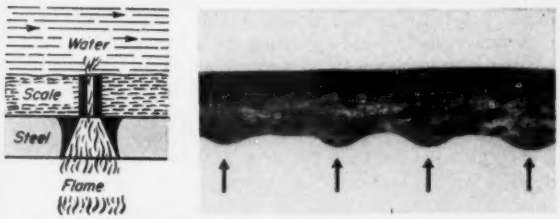
Calcium is most always the largest single mineral element found in natural waters. It usually predominates over magnesium by 2 or 3 to 1. Together, as total hardness, they constitute the bigger group of dissolved solids in natural waters. They appear most frequently

CAUSTIC EMBRITTLEMENT, long-time crippler of riveted boiler surfaces, is now understood and is effectively controlled

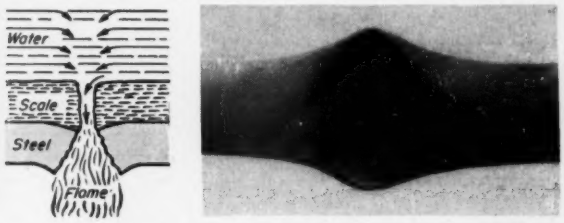
How Scale Formation Ruptures Metal



CLEAN BOILER SURFACE, *left,* absorbs little heat, passes most on to water. As scale builds up, *right,* picture changes



SCALE COATING forces steel to absorb increasing amount of heat, and so tube metal weakens and softens under temperature



RUPTURE OF METAL from too high a local temperature, above, represents the final stage in damage from uncontrolled scale

Sensible, lasting control of boiler scale requires a background of causes, cures. Here's first of 3-part series to give you these data

By **PAUL BRINDISI,** *Chemical Engineer, Celco Laboratories*

in the form of bicarbonates, sulfates and chlorides, and generally in this order of greatness. A fair amount of similar sodium salts will also be included. A small to a goodly portion of silica will most always be present. Other dissolved solids, such as the nitrates of calcium and magnesium along with compounds of iron and manganese as well as alumina, normally appear in much lesser proportions. Still more minerals are contained, but their minute quantities bear no influence on scale development.

Scale Formation. Your raw water may look crystal clear and be quite good for drinking and other purposes. Yet with the above-mentioned mineral impurities it is sure to be far from ideal for your boiler. Why so? Because your boiler is of itself helpless to cope with the disposal of these chemicals. While the water is distilling off as virtually a pure vapor, some dissolved solids are continually precipitating out of solution. Left untreated, they go on to accumulate to damaging proportions, photos, right. Unless aided by chemical means, no amount of blowdown will dislodge these deposits once they attach themselves on the boiler metal.

This scale-forming process occurring in a boiler can be likened to a snowfall. The crystals first alight sparsely, then with greater number and become interlinked, soon to blanket the whole of the affected area, and eventually pack into a thick layer. With scale, however, the result more often is a dense, hard, very adherent incrustation that defies either mechanical or chemical removal.

While these physical traits are typical of scale in general, the chemical composition differs with each case. All chemical components of scale are poor conductors of heat. Their relative proportions, and hence the texture of the composite, determine how much resistance the scale offers to the transfer of furnace heat to the water. The silicates, for example, have a greater insulating effect than the sulfates, and the sulfates more than the carbonates.

Operating Troubles. By far the worst damage scale inflicts is the rupture of boiler tubes, photos right, with the heavy loss of production, time, labor and money their replacement entails. Let us consider a segment of boiler tube, and with the aid of the three sketches, see how its failure occurs.

Just like any other heating utensil, the metal tube acts as a container only. It merely serves as a medium of transfer. It won't be victimized by the heat applied as long as it can pass the heat

Freedom From Boiler-Scale Headaches Will Come Only From Steady Operating Checks

to the substance contained within. But with heavy scale build-up acting as a barrier to an otherwise easy passage of heat to the water, the boiler tube has to sustain virtually the full brunt of the flame temperature. Just how much this scale build-up needs to be before serious damage occurs depends on operating conditions of pressure and temperature.

Temperature on the fire side of the tube may be 2500 F, on the water side as high as 588 F (at 1400 psi). The steel will always retain some heat even if its surface is perfectly clean, so its inside temperature will be somewhat higher than the water. It will remain at this point as long as moving water extracts and carries away the heat the steel has to offer. But with scale impeding this transmission, the steel gradually absorbs more and more of the furnace heat. When the inside temperature of the steel rises above 700 F, its strength begins to give out. On exceeding 900 F, the steel softens to the point of rupture. Chrome-molybdenum or nickel superheater tubes suffer the same failure when deposits cause inside temperatures to surpass 1200 F.

Steam pressure developed over a boiling water acts as a counterforce against further evaporation of that water. The greater this force, the more heat it takes to vaporize the water; hence, the higher the corresponding boiling temperature. It follows, then, that the higher the operating pressure, the closer the inside-tube metal temperature approaches to the weakening point of the metal itself. You can see, then, why it takes proportionally less scale to bring the steel to this stage with increasing pressures. At high operating pressures you can expect a paper-thin deposit to bring on tube failures, whereas at very low pressures heavy scale may be endured for some time.

Amount of heat forced upon the scale-coated metal determines to what extent it will hold out. The more likely danger spots occur within the area of greatest heat transfer, namely those areas exposed to the radiant heat of the fire. This includes the foremost generating bank of tubes, superheater tubes, water walls and front, lower headers of a watertube boiler; the crown sheet and water legs of either a horizontal or vertical firetube boiler. Bagging or bulging in the firetube design, photo, p 84, can lead to violent explosions.

Heat Loss. Scale density and thickness govern the quantity of heat that passes through. With larger, fully equipped boilers the heat repulsed at the generating tube section becomes absorbed in the economizer or air-preheating compartments. Over-all heat loss in such cases may actually be insignificant. But with smaller boilers, especially the types with one or two gas passes, recovery will probably not be quite complete. Stack-gas temperature, consequently, may be considerably higher than normal. The resulting waste of heat proves a sizable loss, if computed over the boiler's length of run.

Scale Removal. Once scale forms, how do you get it off boiler surfaces? Certainly the old axiom holds—"Easy to lay down, but most hard to pull off." You can in time get the scale off mechanically or chemically. Mechanically ridding a firetube boiler of scale cemented between the tubes proves a long, laborious job. Prolonged rattling eventually weakens the tubes' hold on the tube sheets. Manual fishing-out of the loosened scale pieces is always a long drawn-out process. Chipping an hrt shell or watertube drum is another tedious, time-consuming task. Turbining of watertubes is about the same kind of job. Besides, repeated turbining of bent tubes can result in bad scoring at the bends and a lessening of their endurance.

Chemical Removal. Removing scale mechanically is rarely ever complete. Following up with effective internal chemical treatment may eventually loosen the remaining deposit, provided it does not contain too much of the silicates. The phosphate-organic type of boiler compound works well in this application.

Blowdown needs to be increased, though, during the chemical descaling period. Even so, the problem arises of getting rid of the larger scale pieces. They seldom work their way out through blowdown. In fact, quite often they collect in vital sections of the boiler, where they present an even greater threat than the original incrustation. Localized overheating may develop and the metal ultimately succumb to failure. Tube bends and headers, in the combustion chamber of a watertube boiler, and the crown sheet or water legs of a firetube boiler are particularly susceptible spots. To prevent such localized problems pull the unit off the line at more frequent intervals for additional mechanical cleanings.

Acid Cleaning. When scale refuses to yield or is inaccessible to mechanical removal, acid cleaning solves the problem. This cleaning involves circulating a dilute solution through the boiler of one or a combination of several acids fortified by one or more appropriate inhibitors. Consistent testing of the spent acid establishes the desired length of contact time. After draining the acid and flushing with water, neutralize with a weak alkaline solution and thoroughly rewash the boiler. The same process applies equally for economizer or superheater tubes.

Acid cleaning is so risky it should not be undertaken by plant personnel alone. Be sure to always get competent advice and supervision. A careful study of scale analysis, due consideration for the boiler alloys involved, and repeated trial tests have to be gone through before anyone can select the correct acid and inhibitor and determine their respective strengths. What's more, the acid itself or the gases it releases can be injurious to both boiler and operators without constant caution and surveillance.

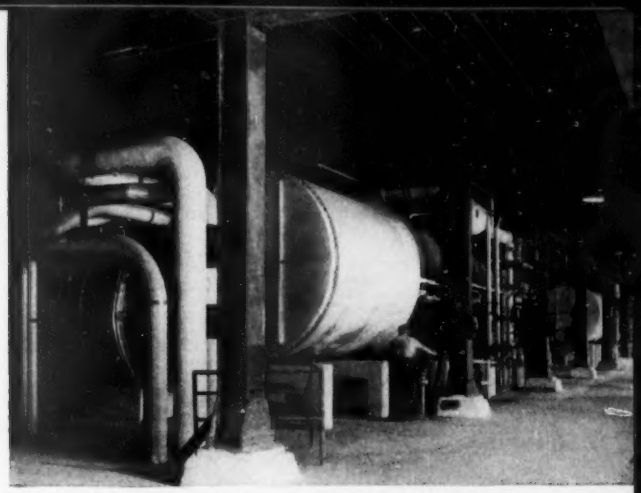
Cleaning Problems. Scale never forms at a uniform thickness throughout the boiler. And the inhibitor affords but limited protection to exposed metal. So removal to the very last remnant of deposit is out of the question lest the acid remain too long in contact with exposed metal surfaces. Furthermore, the larger the proportion of silicates present in the scale, the more futile such an attempt becomes. No matter what, some boiler metal will be lost, either from acid attack during the cleaning or corrosion of the bare metal that follows. This loss may vary from infinitesimal to considerable. Much depends upon the procedure adopted. Heaviest damage occurs at (1) strained sections like tube ends (2) flaws like pit holes (3) blistered or bagged parts.

But as we point out in the first paragraph, the ideal way to handle scale problems is to prevent its formation. In a very early issue we'll get into the mechanics of scale formation, and then spell out how to prevent its happening.

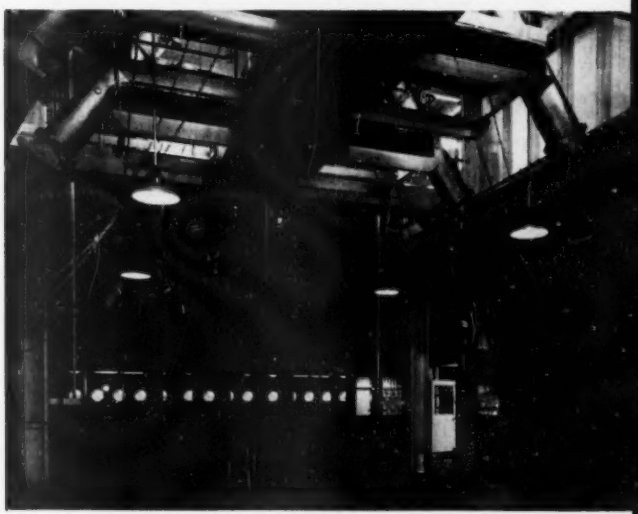
Heavy industry, caught between a growing use of labor-saving tools and a pressing need for more power and steam, is resurveying waste-heat sources, possible steam-making applications, and some new boiler designs. Here is a typical case where . . .

Both Waste-Heat and New Boilers Supply Bigger Steel Mills

By G F WOLFE, *Power Dept, Dravo Corp*



1 Waste-heat boilers produce needed steam from untapped hot gas discharged to atmosphere from open hearths



2 Highly flexible spreader-stoker design permitted full use of coke breeze in new, modern high-pressure boiler room

► THE BASIC STEEL INDUSTRY, long one of the heaviest industrial users of power, finds the newer controls and mechanical equipment in rolling mills and other finish centers imposing still greater demands for power. In the older mills these needs are ever harder to satisfy. Yet through greater use of wastes and modernization of older powerhouses, the heavier demands are being met without serious dislocations.

One of the large steel plants in the Great Lakes area recently handled just such a problem. It met a heavy steam demand with a 2-step approach: (1) installing waste-heat boilers, Fig. 1, in an open hearth building to recover heat going up and out the stacks (2) adding two high-pressure boilers, Fig. 2, in an extension to one end of a boilerhouse. What's more, they extended the other end of the boilerhouse to provide for additional water-treating equipment and rearranged the boiler auxiliary equipment for removal from the building.

Waste-Heat Boilers. The open-hearth building selected for installing the waste-heat boilers is a large structure. It enclosed six furnaces spaced 100 ft apart with the waste gas led away through underground ducts into brick-lined steel stacks. Fortunately, there was ample space between and alongside the stacks to put in the waste-heat boilers without requiring appreciable changes in building structure.

Six tubular boilers, 9 ft 6 in. dia by 22 ft long, went in on concrete foundations. Openings cut into the underground ducts connected to vertical ones at the firing ends of the waste-heat boilers and fed the waste hot gas direct to the boilers. Electrically operated watercooled horizontal valves installed in the vertical ducts gave control over the flow of this waste gas. Once in the waste-heat boiler, the gas moves along under the pull of steam-turbine-driven induced-draft fans to insulated ducts running up through the overhead operating floor to the stacks.

These waste-heat units handle, at design load, 101,000 lb per hr of flue gas at 1200 F entering the superheater section. With this flow rate they generate 14,550 lb of steam per hr each at 250 psi and 525 F. In actual operation, design output has been surpassed considerably.

These new boilers, though, needed water-treating equipment and, of course, boiler auxiliaries. So a new and completely separate building went up by the open hearths. It is a pile-supported steel-framed structure with reinforced concrete floors and roof, brick sidewalls with glass-block panels, and adjustable aluminum louvers for ventilation.

Heart of the waste-heat boilers' water

3 Existing piping plus old foundations complicate job of dropping in up-to-date powerhouse on site of an old one

4 Easier operation from well-laid-out working space dictated boilerhouse extension for auxiliaries and water treatment

Ingenuity and Engineering Combine to Keep Steam Supply Ahead of Demand

treatment is a deaerating hot-process water-softener system and continuous blowdown equipment. The softener system consists of:

1. One high, straight-shell sedimentation tank of welded-plate construction, 10 ft 3 in. dia by 28 ft 9 in.

2. Three straight-side welded-steel-plate code-constructed filters, 5 ft 6 in. dia by 4 ft.

3. One straight-side, 2-compartment welded-steel backwash water tank, designed for 10-psi maximum working pressure. It measures 10 ft 3 in. diameter by 16 ft 3 in.

Sedimentation tank has an internal compartment for deaerating the heated, treated and settled makeup. A balanced steam atomizer, with external shock absorber and control mechanism, performs the deaeration. This atomizer acts as a check valve and prevents water backing into the exhaust line if steam supply to the softener is shut off. Deaerating water-storage compartment has a 16,000-lb volume equal to 10 minutes of outlet capacity of the softener.

Raw-water control for the sedimentation tank consists of a float-operated regulating valve with outside float box. An emergency connection for the heated, treated and settled water uses a float-operated mercoid switch on the deaerated-water compartment, which sounds a warning alarm if cold water does not enter the sedimentation tank. In this way the operator knows when to bypass the filter.

These filters use graded anthracite as a filtering material and are large enough so two can pass the rated output of the softener system while the third is being backwashed.

The 2-compartment backwash water tank has two 8-in. vacuum breakers, overlapping gage glasses, two mercoid switches and double disk regulating valve with outside steel float box for controlling inlet water to the storage or clean side. In addition, a pump of the motor-mounted type with a capacity of 40 gpm at 50-ft total dynamic head takes the backwashing water from the return, or dirty side of the tank, and delivers it to the sedimentation tank.

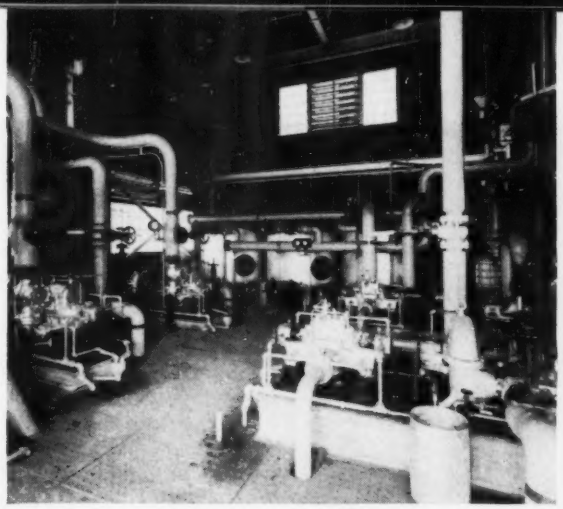
Storage side of the backwash tank fills by gravity from the deaerated-water compartment of the sedimentation tanks. Water flows into the storage compartment through a double-disk regulating valve, with outside float box, large enough for the available head and flow rate desired.

An underground trench carries all connecting piping between water-treatment building and waste-heat boilers. A continuation of this trench running the full length of the open-hearth building accommodates the high- and low-pressure condensate and boiler blowdown lines. High-pressure steam, low-pressure steam and boiler feed lines are carried overhead in the truss structure above the operating floor. Outgoing steam is collected in a 12-in. overhead line, which is carried out the open-hearth building's end to connect with the plant service line, described later.

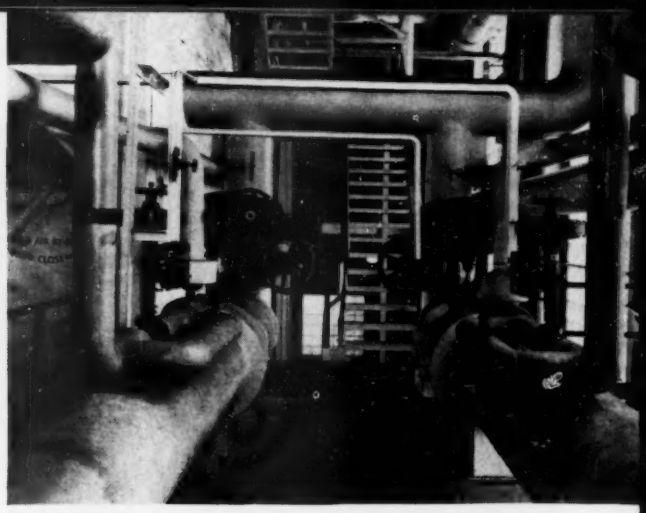
High-Pressure Boilers. Three existing 100,000-lb-per-hr boilers were housed in a building together with all water-treatment equipment and boiler auxiliaries. One of the desired aims was to clear out practically all this equipment to provide proper working space around two new 150,000-lb-per-hr high-pressure boilers. Scarcity of steam dictated that this operation be carried on with the least possible interruption.

What's more, the salvageable existing equipment and all new water-treatment and boiler auxiliaries were slated for a new extension at one end of the existing building. Then the new boilers were to go into an extension at the opposite end. As a result numerous pipe runs had to be made through the boiler area. The net result was a complicated piping arrangement with numerous valves and bypasses for relocating all equipment without interrupting steam production. Much could be written on this point, but careful planning and full cooperation, between the plant and contractor's engineers, plant operators and contractor's field supervisors, permitted us to make all changes as scheduled. Only one steam-station shutdown was required and it was scheduled weeks ahead. With all materials collected beforehand the scheduled work went off so smoothly we shortened the shutdown time originally planned.

Preliminary design studies in the area underlying the proposed extension for the two new boilers, Fig. 2, revealed it had formerly been occupied by furnaces and that after leveling off the old foundations, spread footings could be used. Test pits were dug and it was found that piles were required. Entire area had to be excavated to a depth of about 15 ft to drive the piling. Numerous old concrete walls and foundations were encountered and, since heavy blasting was prohibited, this excavation was difficult and expensive. Also, many underground pipelines had to be either



5 Interior view of 66x85 ft boilerroom extension, photo, facing page, presents orderly setup of pumps, treatment tanks



6 Twin pressure-reducing, desuperheating stations lower boiler steam, 850 psi-850 F to 265 psi-550 F for process

In Older, Established Steel Mills

removed or relocated, and various supporting structures for overhead pipe lines had to be altered to make room for the new construction. All the visible piping in Fig. 3 serves as a good example. Except the two blast-furnace gas lines rising on the building's right side, all this piping had been in place for years.

The two new boilers, each designed to produce 150,000 lb of steam per hr at 850 psi and 850 F, have separate foundations with no structural connection to the building framework. This was desirable because a blowing engine nearby caused a building vibration. During the construction of the boilers temporary struts connected them to the building's steel frame. And even after all boiler setting was in place, the boilers swayed through a small arc at the rate of 100 movements per minute. When the struts were removed, this motion was no longer noticeable.

The boilers fire coke breeze, blast-furnace gas, coke-oven gas and oil, or various combinations of these fuels. Coke breeze, delivered by truck and dumped into a track hopper, is conveyed by a skip hoist and belt conveyor to a 1000-ton-capacity storage bin above and between the two boilers. The coke breeze then feeds by gravity to the spreader stoker, Fig. 2. A clinker grinder and hydrojet system together with a 110-ton hydrobin for storage handles dust and ash disposal.

The blast-furnace gas supply comes from a gas main which paralleled the existing boilerhouse and had to be extended to serve the new boilers. Risers were constructed up the outside of the building with enough horizontal runs inside it to provide for metering. Both gate and butterfly valves went into the drops to the burners and, as an additional safety factor, the gate valves have extended stems to permit handling from the operating floor, the ground floor, and in emergency, even from outside the building.

The increased boiler capacity was accompanied by a corresponding increase in the water-treating facilities, Fig. 5. This increase includes a deaerating hot-process water-softener system of 80,000-gpm capacity, a new sedimentation tank, 27 ft dia by 26 ft 9 in. over the straight-side section, and five new filters, 8 ft dia by 5 ft 6 in. on the straight-side section. The four existing filters were moved into the new buildings and the total of nine filters was arranged in two tiers, one above the other, to save floor space. The sedimentation tank, which had been in use before this expansion, remained in the boilerhouse and, after its internals were removed, was incorporated into the new system as a backwash water-storage tank.

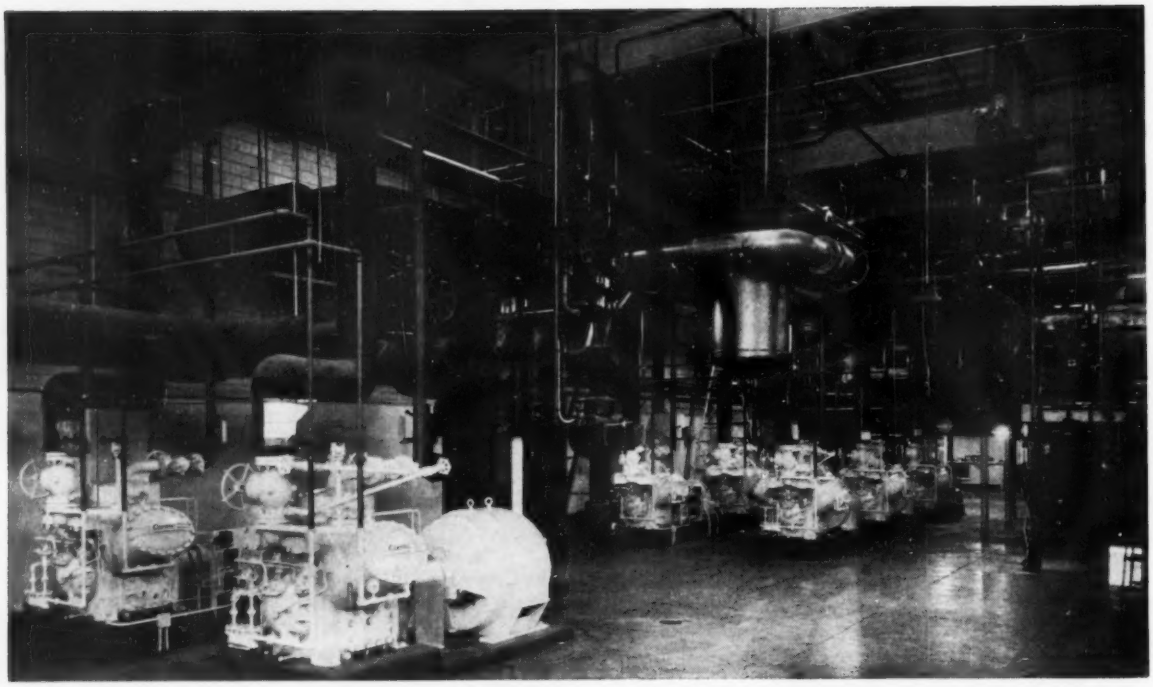
One new turbine-driven boiler feed pump, with a capacity of 600 gpm of 200-F water against 975-psi discharge pressure, was put into the new extension, Fig. 4. One of the three boiler feed pumps was relocated simultaneously with the erection of the new pump, and both pumps were completed and in operation before the two remaining boiler feed pumps were disturbed. A new raw-water pump and a new fuel-oil pump were likewise installed before moving the two corresponding pumps in each case. To minimize spares, all new pumps and their drives were duplicates of existing equipment.

All boiler controls and meters were placed in an enclosed center on the operating floor between the boilers, and all electrical switchgear in a closed room directly overhead. These enclosures were required because of the very abrasive nature of the coke-breeze.

In the original high-pressure system, carbon-moly steel served for main steam and boiler feed valve and piping. Recent developments have indicated that carbon-moly steel is not advisable for temperature service exceeding 800 to 900 F because of a tendency toward metal carbonization in the weld zone in this material. Since the system under construction was in this temperature range, it appeared preferable to use an alloy steel with a one-half percent chrome and a one-half percent moly content.

All chrome-moly pipe weld areas were preheated by the induction method to a temperature of 500 to 550 F before welding. Upon completion of the welds, the joints were wrapped with insulating material, the induction coils placed around the welds and the temperature raised at the rate of 400 F per hr to 1275-1325 F, and held within that range for a 2-hr period for each inch of wall thickness. Temperatures were then reduced at the rate of 200 F per hr to 700 F when the coils were removed and the covered joint left to cool.

The high-pressure steam generated in the new boilers enters a 14-in. header in the original boilerhouse, which serves a topping turbine-generator or passes through the twin pressure-reducing and desuperheating stations, Fig. 6, into a 16-in. plant service line. This line, somewhat more than a mile long, picks up the 12-in. line coming from the waste-heat boilers about midway in its length. It continues to its termination where the steam passes through another pair of pressure-reducing valves and is reduced to 165-psi for plant usage, serving existing equipment.



ALL QUIET in unattended refrigeration plant. Relays will shut down machines and send signal if . . .

FAULTS THAT FLASH A SIGNAL TO ADT

These Defects Shut Down Complete Plant

- Leak in brine system drops liquid level to trip float switch
- Drop in brine temperature operates detector in cooler head
- Failure of cooling water flow sets off pressure-control relay
- Interruption of dc feed to motors drops out voltage relay
- Excessive refrigerant-pressures operate high-pressure cutouts

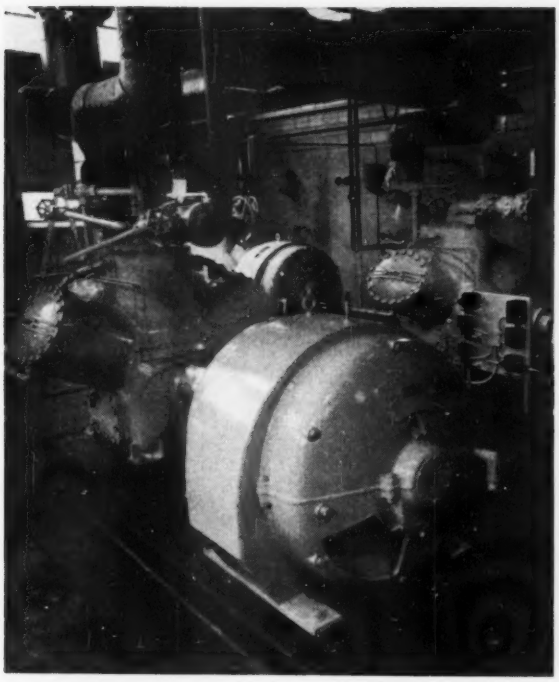
These Defects Shut Down Individual Machines

- Rise in ammonia level, in accumulators of blast freezer, brine cooler and ammonia-cooled intercooler, trips relays
- Drop in lube pressure operates compressor oil-failure switch
- High temperature in blast-freezer room sets off thermostat

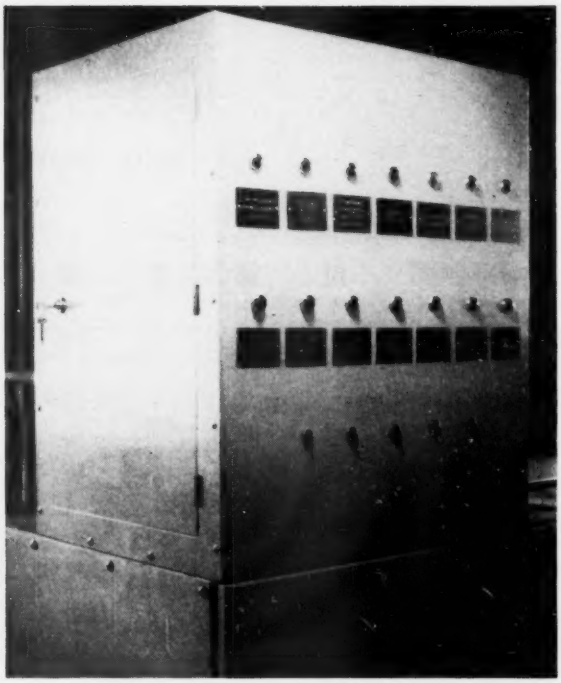
By NILS R BERNZ
Vice President and Director of Engrg
Merchants Refrigeration Co

Here is another milestone in the trend toward automatic plant operation. Merchants' refrigeration warehouse in Hopkins, Minn. can be left unattended for long periods with relays keeping constant watch. Trouble flashes lamp in the ADT central office. Experience shows . . .

...Unattended



. . . TROUBLE POPS in machines or piping . . .

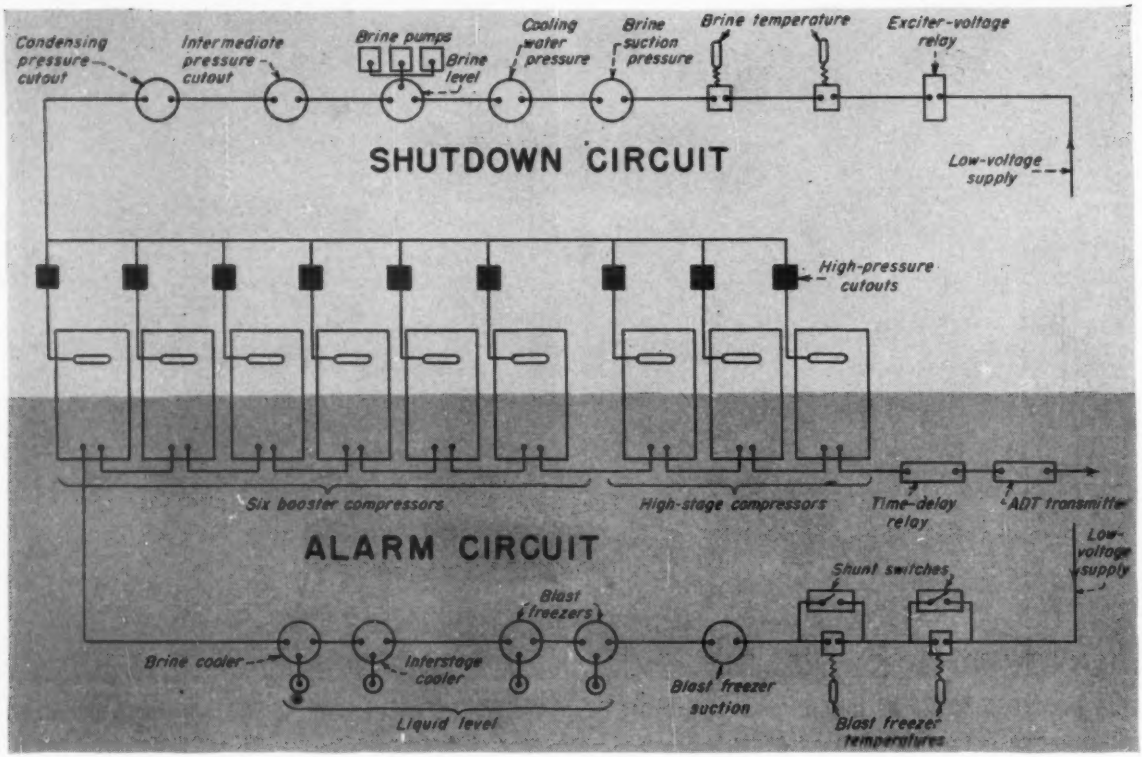


. . . FLASHING LAMP in ADT office and plant

PLANT OPERATOR, called by ADT, clears trouble, then puts machines back in operation

Plant Runs Smooth With Remote Signals

MORE ON NEXT PAGE



AUTOMATIC INDICATING system is divided so certain group of instruments and controls will immediately shut down the plant on trouble. Another control group shuts down but one machine. Both control groups will send an indication to the ADT office

Compressors Are Powered by Unity-Power-Factor Synchronous Motors...

► LOCKING THE DOOR on 1,750,000 cu ft of refrigerated space for 16 or more hours at a stretch calls for a dependable trouble-indicating system . . . one that shuts down one or more machines, if need be, plus sending a signal to a central office. The signal, in our case, is sent to a local office of the American District Telegraph. Circuits are like those for fire-alarm protection.

Our plant has a total refrigerating capacity of about 275 tons; 175 tons for storage purposes through a brine cooling system; remainder serves blast-freezer rooms. Blast-freezer capacity is 100,000 lb of produce for 24 hr at –30 F. Blast freezer operates through direct-expansion ammonia system.

Refrigeration equipment centers about nine 6-cylinder 720-rpm 2-stage compressors. They represent a total of 960 hp, synchronous motors. Consider the refrigeration system as operating two loads; brine-cooled storage rooms and direct-expansion blast freezers. Of the nine compressors in the plant, six handle the first stage, while three are in the second. Piping is so arranged that any of the low-stage units can be run on brine suction or blast freezing. Each compressor is well protected from accidental damage as indicated in above sketch.

Brine circulated through a fin-pipe system is cooled by multi-pass brine coolers connected to an ammonia accumulator. Banks of fin coils pick up heat, transmit it to the circulating brine. Accumulated frost is removed by circulating hot brine through the system. Compressed ammonia gas, as it is discharged from the high-stage machines, is piped to a bank of six evaporative condensers on the plant roof.

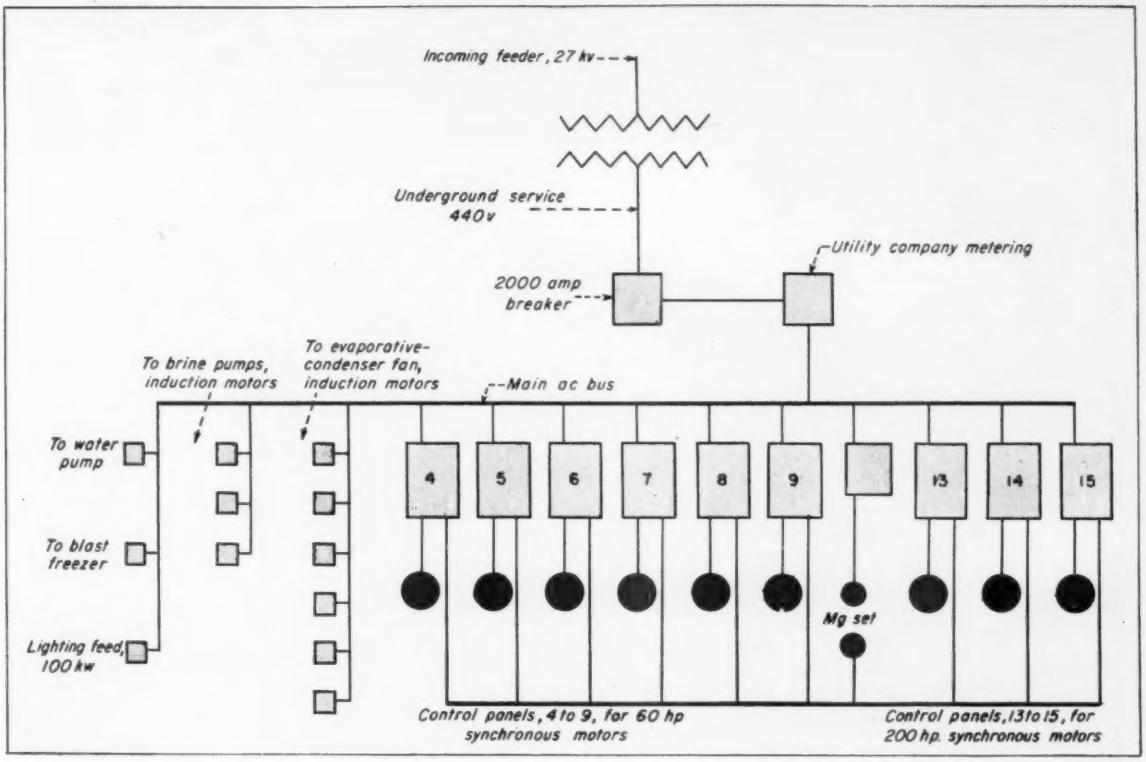
Electrical system is spread about a nucleus of nine synchronous motors. They power the refrigeration compressors. Six of the nine are 60-hp motors that drive the low-stage reciprocating compressors. These units serve for the blast freezing operation or brine cooling for storage areas. They operate at suction temperatures to –40 F. Likewise, the three remaining high-stage reciprocating compressors are each driven by a 200-hp synchronous motor. Here an mg set is used to supply the common dc bus. In our case motors were picked that will operate normally at unity pf.

Keep in mind, however, that some synchronous motors are designed to run at a leading power factor. This is important where much of the remaining load is induction motors, drawing a sizable chunk of wattless power. Size and number of leading pf synchronous motors used hinges on amount of reactive kva needed to balance out effects of inductive equipment. This consideration did not come into the picture for us. Our major power loading consists of synchronous motors; there is little lagging reactive power to account for.

All synchronous motor controls are low-voltage fuse type. They are equipped with disconnect time-lag fuses permitting full-voltage starting. A polarized field frequency synchronous-motor control system is used throughout.

The local utility company supplies all electrical power. After passing through a 27-kv to 440-v stepdown transformer, the underground electrical feed is run through a 2000-amp service. Our main ac bus is at 440 v. Each of the synchronous motors feed off this bus.

Excitation for the synchronous motors



ELECTRICAL DISTRIBUTION within the plant stems from the 27-kv feeder from local utility company. All motors are tapped into the main 440-v ac bus. Excitation for the synchronous motors comes from separate mg set. Relay indicates a dc failure

...Totaling 960 Hp

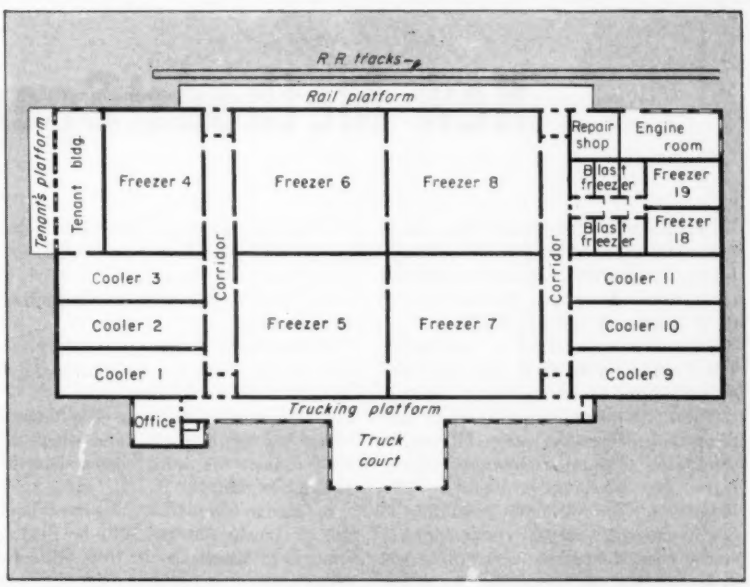
is supplied by an mg set, whose motor is tapped into the main station bus. Generator of this mg set feeds a dc bus which, in turn, delivers dc excitation power to each synchronous motor.

Remote Indication. As indicated above, the remote signaling system we adopted is a companion to the conventional protective system as far as wiring and operation go. It simply means using another circuit to the ADT office.

A signal is transmitted to the ADT office if there's a significant mechanical or electrical failure, or if an abnormal temperature or pressure is reached. When the signal is received in the central office, the ADT telephones the operating engineer at his home. If he cannot be reached, a local refrigeration service organization, previously selected, is called. The operating engineer or refrigeration serviceman then drives to the plant, locates the trouble, and puts the machine back in operation.

Controls that shut down equipment are also wired to indicating lights in the plant. When trouble pops, these lights go on and remain lit till reset by the man shooting trouble. They serve as a tip-off to the trouble source for the person answering the ADT call. In this way he can quickly tell which control device caused the shutdown.

System was designed by the author and P B Christenson, formerly with the Merchants Refrigeration Co, in consultation with J Holbrook of Belden-Porter Co and V Alexander, L Hanson, A Heintz of the Carrier Corp.



REFRIGERATION LOAD is supplied by 175 tons brine-cooling refrigeration working in 2-stage system. There are 100 tons of refrigeration at –30 F for blast freezing

TWO-ENGINE SCRAPER, rubber-tired and self-loading, has high average travel speed and hence great production capacity. It shows to greatest advantage on stockpiles over 100,000 tons needing piling or reclaiming rates of more than 150 tph

New Methods Speed Large Coal

► To an ever greater extent, large industrial users of coal resort to stockpiling as insurance against supply interruptions. Estimates indicate that 20 to 30% of coal deliveries to large consumers are transferred to stockpiles. These range up to 100 ft high, and well over a million tons.

There are numerous problems in handling huge tonnages into and out of stockpiles. Foremost factor, of course, is cost. But secondary problems are also important. These include possibility of fire from spontaneous combustion of stored coal, difficulties in handling wet or frozen coal, and need for minimizing moisture content to prevent clogged bunkers or chutes and combustion difficulties on stokers.

An ideal system for stockpiling coal would be able to do these jobs:

1. Handle average tonnage economically yet have adequate reserve.
2. Move loose or compacted coal, either wet or frozen.
3. Spread coal uniformly in thin layers and compact it to a density that reduces hazard of heating.
4. Build a pile with good drainage characteristics.
5. Handle all grades and sizes.
6. Control segregation and mix grades of coal while reclaiming.
7. Hold labor needs to a minimum, show low maintenance and operating cost, require low initial investment, offer high availability.
8. Change from stockpiling to reclaiming efficiently and quickly; be flexible enough to handle coals from different types of receiving systems into different plant handling systems.
9. Permit altering easily the height, width, size and location of pile.

Capacity Needed. Industrial users generally receive coal by rail, boat or barge. Large tonnages may be unloaded intermittently into a stockpile, and total amount "handled" yearly may well exceed annual plant coal consumption. Because of this intermittent delivery, stockpiling equipment should have capacity enough to handle peak arrival tonnages so cars or barges are not held too long. Steam plants with dual-fuel systems must have stockpile reclaiming equipment adequate to handle peak fuel needs if oil or gas supply fails.

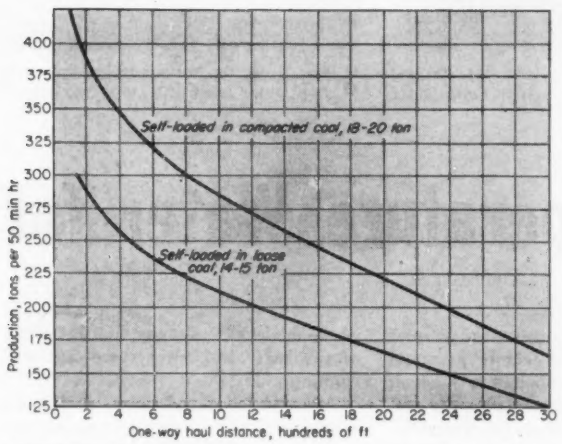
Coal is stored and reclaimed by bridge cranes, conveyors and stackers, clamshell cranes of various types, cable-operated drag scrapers and shovel-loaded highway dump trucks. These methods display different advantages and disadvantages in first cost, maintenance and operation expense, compacting ability and flexibility.

Tractor Equipment. In the late 1930s, the crawler tractor with bulldozer, commonly used for earth moving, was applied to coal stockpiling. For short-hauls it offered numerous advantages: low investment and labor costs, great compacting ability and flexibility in building piles of various sizes.

Table I — Costs for Various Rates, Hauls

Based on 2-engine scraper

One-way haul, ft	Loose coal Rate, tph	Loose coal Cost, ¢/ ton	Compacted coal Rate, tph	Compacted coal Cost, ¢/ton
100	315	4.0	425	3.0
300	280	4.6	370	3.5
400	260	4.9	350	3.6
900	220	5.8	290	4.4
2000	170	7.5	230	5.6



PRODUCTION CAPACITIES of 2-engine scraper self-loading in both loose and compacted coal, based on actual field studies

Table II — Estimated Hourly Cost, 2-Engine Scraper

1. Depreciation:		
Purchase price	$51,070	
Freight (63,375 lb at $1.50 per 100 lb.)	950	
Delivered price	$52,020	
Less original value of tires (see No. 3)	8,963	
Total amount to be depreciated	$43,052	
Divided by depreciation period (15,000 hr)		$2.88
2. Interest, Taxes, Insurance and Storage		
Estimated at 10% of average yearly investment (6% interest, 2% taxes, 2% insurance and storage)		
Average yrly investment, 6 yr, is 58.3% delivd price.		
Delivered price ($52,020) x 58.3% x 10% =		$1.22
Hours operated per yr (2500)		
Total Hourly Ownership Cost		**$4.10**
3. Tire Replacement Cost:		
Front tires (12.00x24, 16 ply) two req'd	$ 546	
Drive tires (24.00x25, 24 ply) two req'd	3136	
Trailer tires (27.00x33, 30 ply) two req'd	5286	
Total value of original tires	$8968	
Divided by estimated tire life — Tractor—4000 hr	$0.92	
Divided by estimated tire life — Scraper—5000 hr	$1.05	
Total tire replacement cost		$1.97
4. Tire Repairs (estimated 10% of hourly tire cost)		$0.20
5. Repairs (including parts and labor)		$1.90
6. Cutting Edge (replacement estimated)		$0.20
7. Fuel (estimated use 14 gal/hr at 14 c/gal)		$1.96
8. Oil, Grease (including greasing labor)		$0.42
9. Operator (incl Social Security, compensation)		$2.00
Total Hourly Operating Cost		**$8.65**
Total Estimated Hourly Ownership and Operating Cost		**$12.75**

Stockpiling Operations

By R A NUSSMEIER
The Euclid Road Machinery Co

Extensive tests by a large Eastern power company, using three types of large crawler tractors and bulldozers, indicated productions of over 500 tons per hr on a 50-ft push, down to 200 tph on a 300-ft push. Beyond 300 ft, hourly tonnage dropped rapidly.

Pulling rubber-tired carry-type scrapers extends the economical work range of crawler tractors. Depending on size, such units can pick up from 10 to 20 tons of coal and haul it well over 1000 ft at relatively low cost. In a 1949 ASME paper, J Norton Ewart, chief mechanical engineer, Buffalo Niagara Electric Co, described five years of coal stockpiling experience with crawler bulldozers and crawler-drawn rubber-tired scrapers. The scrapers carried 13 tons per trip on an average 700-ft haul, for an hourly production of 75 tons. Costs for a 1000-ft haul averaged 11.2c per ton (operation and maintenance only).

Rubber-Tired Units. As stockpiles became larger and longer, low average travel speed of crawler machines began to loom as a limiting factor. In the earth-moving field, just before World War II and continuing thereafter, there was a trend to self-propelled rubber-tired scrapers. These units lowered costs on long hauls because rubber tires made higher haulage speeds possible. Applied to stockpiling, they increased production ability. A push tractor was used for satisfactory loading of the single-drive-axle machine.

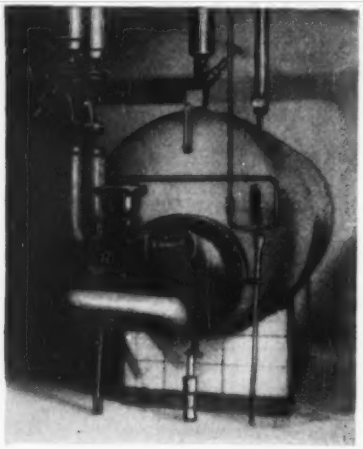
Self Loading Scrapers. Later, a rubber-tired self-loading scraper with two engines was developed. One engine powers the scraper wheels and the other the tractor drive wheels. Initial tests in coal stockpiling and reclaiming were made early in 1950 at a St. Louis power plant. In them, the 2-engine scraper showed ability to self-load in either compacted or loose coal. Rubber tires and high power-to-weight ratio gave this design high average travel speed, and hence great production capacity. The 2-engine design thus offers an answer to problems of large stockpiling operations.

Production Rates. Fig. 1, based on actual field studies, shows production capacities of a 2-engine scraper self-loading in both loose and compacted coal. These indicate suitability for high rates and long hauls. The figures in Table I show costs for various rates and hauls. While on short hauls other types may prove more economical, the 2-engine design begins to come into its own at haul distances above about 400 ft and shows low costs for hauls as long as 2000 ft.

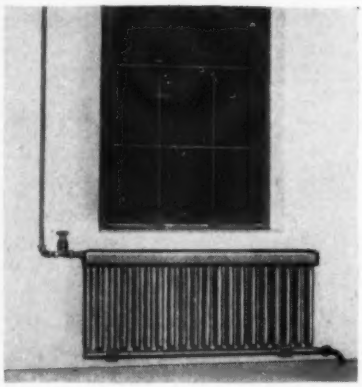
Many factors affect choice of a particular type for a given job. Primary consideration is ability to handle both average and peak tonnages at low cost.

Consider, for example, a typical power plant of 200,000-kw capacity. Peak output would require, on the aver-

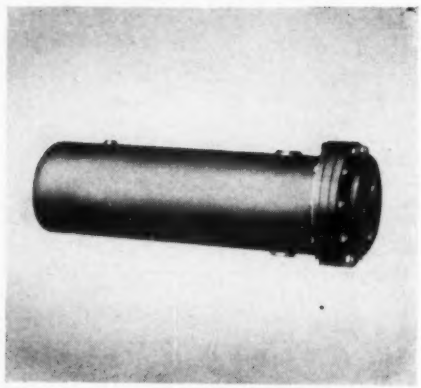
(*Continued on page* 212)



1 Heat exchanger for generating steam (2 to 150 psig) from high-temp water



2 High-pressure steel radiator for use in space heating on high-temp water



3 For domestic hot-water heating with h-t water, use this type exchanger

Consider High-Temperature Water for

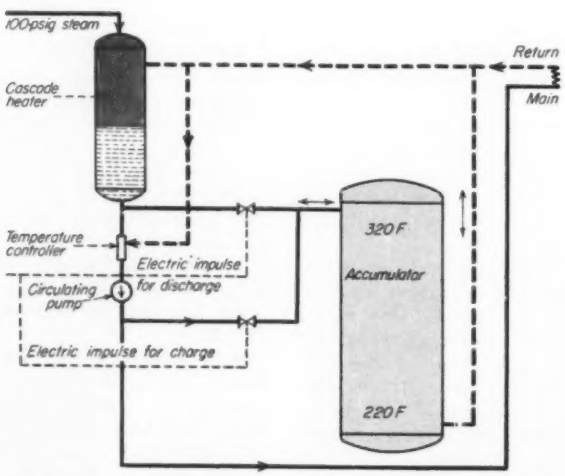
Tick off the plants that can use high-temperature water in process and heating systems and you'll have an impressive list. Here's a quick review of latest design thinking of importance to all future users

By **ALEXANDER KULI**, *Engineer*
American District Steam Co, Inc

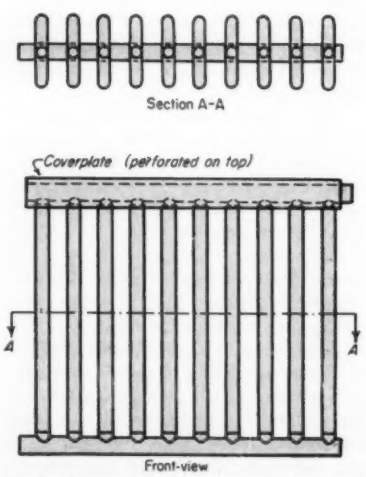
► BECAUSE THEY OUTLINE principles of a system not yet widely accepted in America, Owen Lieberg's articles on high - pressure high - temperature hot water were most welcome (POWER, May and June 1952). European engineers have obtained excellent results with this system for many years, but only in the last 25 years have American engineers given it much thought.

Origins. H-p h-t hot water is not a completely new idea. Its forerunner, the Perkins heating system, was used in England and on the Continent more than 100 years ago. This system was closed but had no circulating pump, the heart of the modern h-p h-t installation. Many of the early English systems are still running today.

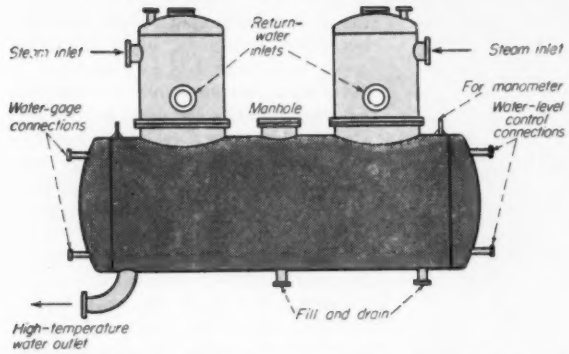
Advantages. Good points of h-p h-t systems of interest to all engineers include: (1) Completely closed piping system of simple design does not need condensate-return equipment or pressure reducers. (2) Negligible makeup reduces amount of water treatment needed. (3) Boilers are scale-free, have high efficiency. (4) In space heating, output is easily controlled. (5) Piping system has small temperature drop—about 3 F per mile. (6) There is no pipe corrosion. (7) Maintenance cost



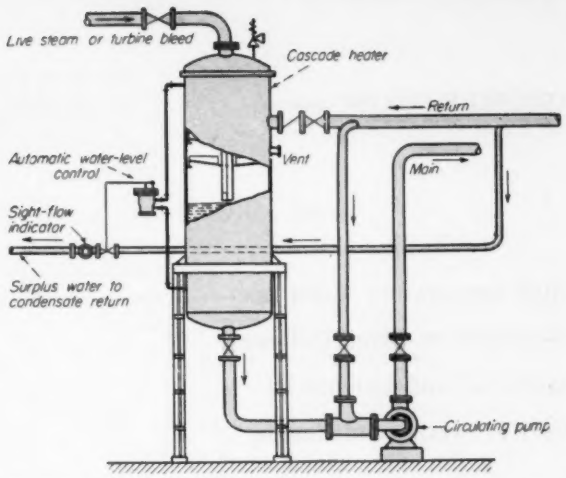
6 This is one way of hooking up a high-temperature water accumulator. Control may be either manual or automatic



7 High-pressure steel radiators are widely used in Europe for heating



4 Large-capacity direct-contact cascade heaters consist of a horizontal expansion tank with heaters in the two domes



5 Piping layout for a typical vertical direct-contact cascade heater for a high-temperature water-heating system

Your Process and Space-Heating Jobs

for simple piping and valves is low. (8) Pipeline is easy to install because it follows ground contours. (9) System has large heat-storage capacity that reduces peak loads on boilers, equalizes heat demand and production. (10) There is no water hammer.

Chief advantages are fuel and maintenance savings together with productivity increase from more exact temperature control. These are important in plywood, rubber, plastics, textile, food processing and other industries. Fuel savings of 25 to 40% are recorded in many plants in Germany, Switzerland, Austria, Italy, France and other European countries where steam-heating systems were converted to h-p h-t water. In Nurnberg a large electric company is presently converting from steam to h-p h-t water and has saved 43% in fuel by eliminating the condensate return line.

What Is It? High-temperature water is water heated to above 212 F, the boiling point at atmospheric pressure. Its pressure corresponds to the saturation value at the given temperature.

Though called by a number of different names, including high-pressure hot water, high-pressure high-temperature water, superheated water, high-temperature hot water and high-temperature (h-t) water, I believe the last is the best and briefest name. We will use it throughout the remainder of the article.

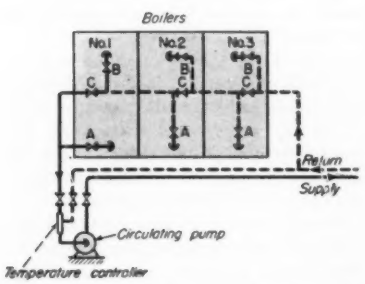
Conversions. Many engineers acknowledge that this system is the most economical and efficient for new plants but object to converting an existing steam system to h-t water because of high cost. Though labor costs more in America than in Europe, while fuel is cheaper, no plant should overlook a fuel saving of 30% or more. This is just what h-t water offers.

H-t water lowers production costs. Conversion from steam to h-t water does not have to be done overnight; it can be carried out gradually. Eighty per cent of h-t water installations replace former steam systems. Usually conversion was gradually made. Units like that in Fig. 5 help in system conversion.

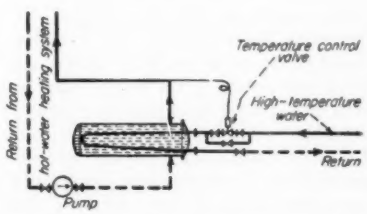
Cascade Heaters. These, Fig. 4 and 5, use live or bled steam to generate h-t water. An expansion vessel with water-level control, it has a series of water-dispersing units called cascades or trays. These expose a large surface of the water for fast, efficient heat absorption.

Steam enters heater top, filling vessel to water level. Water entering heater side comes in direct contact with steam, condensing it. Level of water is automatically controlled, surplus water being discharged through condensate return main to the boiler. Surplus water is usually taken from heater return line, Fig. 5. Water at this point is the coldest in the system.

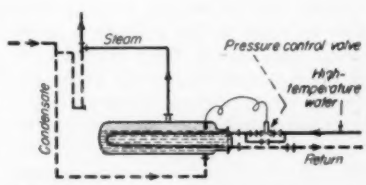
Circulating pump below heater forces



8 Connect boilers in series to raise storage capacity of h-t water system

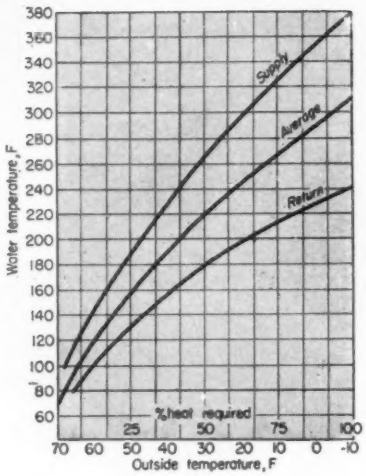


9 Heat exchanger using h-t water replaces boiler in hot-water heating

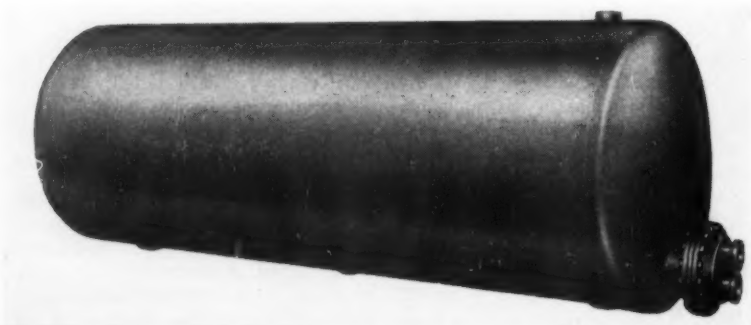


10 Hookup to generate steam from h-t water in a tubular heat exchanger

High-Temperature Water Is Adaptable to Many Different Industrial and Commercial Uses in Process and Heating



11 In space heating, flow temperature depends on outdoor air temperature



12 Where large quantities of domestic water are needed you can use a heater like this instead of the unit shown in Fig. 3. Efficiency of these units is good

water into steam space, through the return main. Trays break it into a fine spray and leaving water has same temperature as saturated steam used for heating. Direct contact provides high heat-transfer efficiency.

Circulating pump is placed far enough below heater to obtain sufficient head to prevent steam flashing and water hammer in the lines. For large capacities, direct contact heaters may be mounted on horizontal expansion tanks in the form of domes, Fig. 4.

Using cascade heaters you can generate h-t water at any point in a steam plant. This makes them feasible for jobs like new space heating or for replacing worn-out steam systems. Heater needs only small floor area and can be located in production spaces, if necessary. No more maintenance is needed than with other types of heat exchangers in usual power-plant service.

Heat Storage. Heat consumption in most plants varies throughout the day. In steam-heating systems, variation of heat consumption changes boiler pressure, and boiler firing rate must be varied with load changes. In h-t water systems the large volume of water permits changes in heat demand without appreciable variation of boiler pressure. Boiler efficiency is higher because firing rate is more even.

Increase h-t water system capacity by connecting boilers in series. Fig. 8. Of the three boilers shown, No. 1 is the so-called steam boiler, No. 2 and 3 are filled with water. All boilers can be fired at the same time, but No. 2 and 3 must have a lower rate than No. 1.

Properly designed h-t water systems generally have enough spare capacity to meet fluctuations in heat demand. An extra accumulator is needed only in systems where power and heat peaks do not coincide, and exhaust or bleed steam is used for water heating. The same is true of systems having boilers that are shut down during the night and that have a high peak load in morning.

H-t water accumulators are simpler and more effective than steam type because the latter run at varying pressures. Also, storage tanks for h-t water are much smaller than those for steam systems with the same heat-storage capacity. Cylindrical tanks with dished heads make suitable h-t water accumulators. They may be placed outdoors, if desired.

Piping. Fig. 6 shows one way of hooking up an accumulator. During charging, h-t water enters accumulator top at 320 F. It pushes cooler 220-F water from accumulator bottom to the cascade heater. During discharge, hot water is taken from accumulator top while cooler water returning from system enters the bottom.

A narrow layer about 1 ft deep separates the high-temperature water from the low-temperature water below it and eliminates mixing or turbulence of water in the accumulator. Regulating valves for charge and discharge are usually operated by hand because peak-load periods are short. But an automatic regulator may also be used as is shown in Fig. 6.

Tubular Heaters. Fig. 9 shows how a heater of this type is used to replace a boiler in a low-temperature hot-water heating system. In Fig. 10 a h-t water heater generates steam for process or other uses. Be sure temperature of h-t water is higher than that of steam to be generated.

Temperature Control. For space heating, system output is a function of outdoor temperature. The lower the outdoor temperature, the more heat needed. Since heating plants are designed for specific low outdoor temperature, output must be controlled on warmer days to avoid overheating.

Many different temperature regulators may be used for steam-heating systems but in water-heating systems indoor temperature is varied by changing the temperature of the water being circulated. Amount of variation, in turn, depends on the outdoor temperature at the time.

In h-t water systems, temperature is regulated at a central location. Bypass and mixing valve regulate temperature of leaving water so it is suitable for heating needed. Chart, Fig. 11, can be prepared for a given plant to simplify figuring of best water temperatures.

Return water is bypassed either manually or by an automatic ratio controller. Most plants in Europe use manual bypasses except for some process heating where 3-way ratio controllers are used.

Alloy Steel Pipe—ASTM Specification A-315 (1 Cr, ½ Moly)

Pipe size in.	Nom. OD in.	Wall thick. in.	Temperature – F: To 750	800	850	900	950	1000	1050	1100
			Maximum allowable stress – psi: 15,000	14,750	14,200	13,100	11,000	7500	5000	2800
Schedule 10										
14	14	.250	330	324	312	288	242	165	110	61
16	16	.250	285	280	270	248	209	142	95	53
18	18	.250	255	251	241	223	187	127	85	47
20	20	.250	225	222	213	196	165	112	75	42
24	24	.250	195	191	184	170	143	97	65	36
Schedule 20										
8	8.625	.250	540	531	511	471	396	270	180	101
10	10.75	.250	435	427	411	380	319	217	145	81
12	12.75	.250	360	354	340	314	264	180	120	67
14	14	.312	450	442	426	393	330	225	150	84
16	16	.312	390	383	369	341	286	195	130	72
18	18	.312	345	339	326	301	253	172	115	64
20	20	.375	405	397	383	353	297	202	135	75
24	24	.375	330	324	312	288	242	165	110	61
Schedule 30										
8	8.625	.277	630	620	596	550	462	315	210	117
10	10.75	.307	570	560	540	498	418	285	190	106
12	12.75	.330	540	531	511	471	396	270	180	101
14	14	.375	570	560	540	498	418	285	190	106
16	16	.375	495	486	469	432	363	247	165	92
18	18	.437	540	531	511	471	396	270	180	101
20	20	.500	570	560	540	498	418	285	190	106
24	24	.562	540	531	511	471	396	270	180	101
Schedule 40										
1/2	.84	.109	1695	1667	1605	1480	1242	848	565	316
3/4	1.05	.113	1455	1430	1377	1271	1067	727	485	271
1	1.315	.133	1575	1549	1491	1375	1155	788	525	294
1¼	1.66	.14	1065	1047	1008	930	781	532	355	198
1½	1.90	.145	1005	988	951	877	737	503	335	187
2	2.375	.154	900	885	852	786	660	450	300	168
2½	2.875	.203	1215	1195	1150	1061	891	607	405	226
3	3.50	.216	1095	1077	1036	956	803	548	365	204
4	4.50	.237	975	959	923	851	715	488	325	182
5	5.563	.258	885	870	838	773	649	443	295	165
6	6.625	.28	840	826	795	734	616	420	280	156
8	8.625	.322	765	752	724	668	561	382	255	143
10	10.75	.365	720	708	681	628	528	360	240	134
12	12.75	.406	690	679	653	603	506	345	230	128
14	14	.437	690	679	653	603	506	345	230	128
16	16	.50	705	693	667	616	517	352	235	131
18	18	.562	720	708	681	628	528	360	240	134
20	20	.593	690	679	653	603	506	345	230	128
24	24	.687	675	664	639	590	495	338	225	126
Schedule 60										
8	8.625	.406	1035	1017	980	904	759	518	345	193
10	10.75	.50	1065	1047	1008	930	781	532	355	198
12	12.75	.562	1035	1017	980	904	759	518	345	193
14	14	.593	1005	988	951	877	737	503	335	187
16	16	.656	975	959	923	851	715	488	325	182
18	18	.718	1005	988	951	877	737	503	335	187
20	20	.812	990	973	937	864	726	495	330	184
24	24	.937	1005	988	951	877	737	503	335	187
Schedule 80										
1/2	.84	.147	3030	2979	2868	2646	2222	1515	1010	566
3/4	1.05	.154	2595	2551	2456	2266	1903	1297	865	484
1	1.315	.179	2595	2551	2456	2266	1903	1297	865	484
1¼	1.66	.191	1935	1902	1831	1690	1419	968	645	361
1½	1.90	.20	1815	1785	1718	1585	1331	908	605	339
2	2.375	.218	1665	1638	1576	1454	1221	833	555	311
2½	2.875	.276	1935	1902	1831	1690	1419	968	645	361
3	3.50	.30	1770	1740	1675	1545	1299	885	590	330
4	4.50	.337	1605	1578	1519	1401	1177	803	535	299
5	5.563	.375	1470	1445	1391	1283	1078	735	490	274
6	6.625	.432	1470	1445	1391	1283	1078	735	490	274
8	8.625	.50	1335	1312	1263	1165	979	667	445	249
10	10.75	.593	1305	1283	1235	1140	957	653	435	243
12	12.75	.687	1305	1283	1235	1140	957	653	435	243
14	14	.75	1305	1283	1235	1140	957	653	435	243
16	16	.843	1305	1283	1235	1140	957	653	435	243
18	18	.937	1305	1283	1235	1140	957	653	435	243
20	20	1.031	1305	1283	1235	1140	957	653	435	243
24	24	1.218	1290	1269	1221	1127	946	645	430	241
Schedule 100										
8	8.625	.593	1650	1622	1562	1441	1210	825	550	308
10	10.75	.718	1635	1608	1548	1428	1199	817	545	305
12	12.75	.843	1650	1622	1562	1441	1210	825	550	308
14	14	.937	1695	1666	1605	1480	1243	847	565	316
16	16	1.031	1635	1608	1548	1428	1199	817	545	305
18	18	1.156	1650	1622	1562	1441	1210	825	550	308
20	20	1.25	1650	1622	1562	1441	1210	825	550	308
24	24	1.50	1665	1638	1576	1454	1221	833	555	311

Pipe size in.	Nom. OD in.	Wall thick. in.	Temperature – F: To 750	800	850	900	950	1000	1050	1100
			Maximum allowable stress – psi: 15,000	14,750	14,200	13,100	11,000	7500	5000	2800
Schedule 120										
4	4.50	.437	2225	2198	2115	1951	1639	1117	745	417
5	5.563	.50	2130	2094	2016	1860	1562	1065	710	397
6	6.625	.562	2040	2008	1931	1781	1496	1020	680	381
8	8.625	.718	2070	2035	1960	1808	1518	1035	690	386
10	10.75	.843	1980	1947	1874	1729	1452	990	660	369
12	12.75	1.00	2010	1977	1902	1755	1474	1005	670	375
14	14	1.062	2010	1977	1902	1755	1474	1005	670	375
16	16	1.218	1980	1947	1874	1729	1452	990	660	369
18	18	1.343	1995	1962	1889	1742	1463	998	665	372
20	20	1.50	1965	1931	1860	1716	1441	983	655	367
24	24	1.75	1995	1962	1889	1742	1463	998	665	372
Schedule 140										
8	8.625	.812	2385	2343	2257	2083	1749	1192	795	445
10	10.75	1.00	2400	2360	2272	2096	1760	1200	800	448
12	12.75	1.125	2295	2257	2172	2004	1683	1148	765	428
14	14	1.25	2340	2301	2215	2043	1716	1170	780	437
16	16	1.437	2370	2330	2243	2070	1738	1185	790	442
18	18	1.562	2310	2271	2187	2017	1694	1155	770	431
20	20	1.75	2340	2301	2215	2043	1716	1170	780	437
24	24	2.062	2310	2271	2187	2017	1694	1155	770	431
Schedule 160										
1/2	.84	.187	4545	4469	4302	3969	3333	2272	1515	848
3/4	1.05	.218	4500	4425	4260	3930	3300	2250	1500	840
1	1.315	.25	4290	4218	4061	3746	3146	2145	1430	800
1¼	1.66	.25	3000	2950	2840	2620	2200	1500	1000	560
1½	1.90	.281	3090	3039	2925	2698	2265	1545	1030	577
2	2.375	.343	3225	3171	3053	2816	2365	1613	1075	602
2½	2.875	.375	2970	2920	2811	2593	2178	1485	990	554
3	3.50	.437	2940	2891	2783	2567	2156	1470	980	549
4	4.50	.531	2965	2817	2712	2502	2101	1433	955	535
5	5.563	.625	2790	2743	2641	2436	2046	1395	930	521
6	6.625	.718	2730	2684	2584	2384	2002	1365	910	510
8	8.625	.906	2715	2669	2570	2371	1991	1358	905	507
10	10.75	1.125	2760	2714	2613	2410	2024	1380	920	515
12	12.75	1.312	2730	2684	2584	2384	2002	1365	910	510
14	14	1.406	2670	2625	2527	2332	1958	1335	890	498
16	16	1.562	2670	2625	2527	2332	1958	1335	890	498
18	18	1.75	2670	2625	2527	2332	1958	1335	890	498
20	20	1.937	2655	2610	2513	2318	1947	1328	885	495
24	24	2.312	2655	2610	2513	2318	1947	1328	885	495

Maximum Allowable Working Pressure—6

► HERE'S THE LAST in the series of six data sheets to speed up selecting correct pipe sizes. No. 1 appeared in July, and No. 2 to 5 in September to December 1952, respectively. These tables help avoid calculation errors in addition to saving time.

All tables are based on allowable stresses published in August 1951 issue of *Mechanical Engineering* and the p/s values given in Crane Co catalog No. 49.

BY GEORGE C HALZEL *Boston, Mass.*

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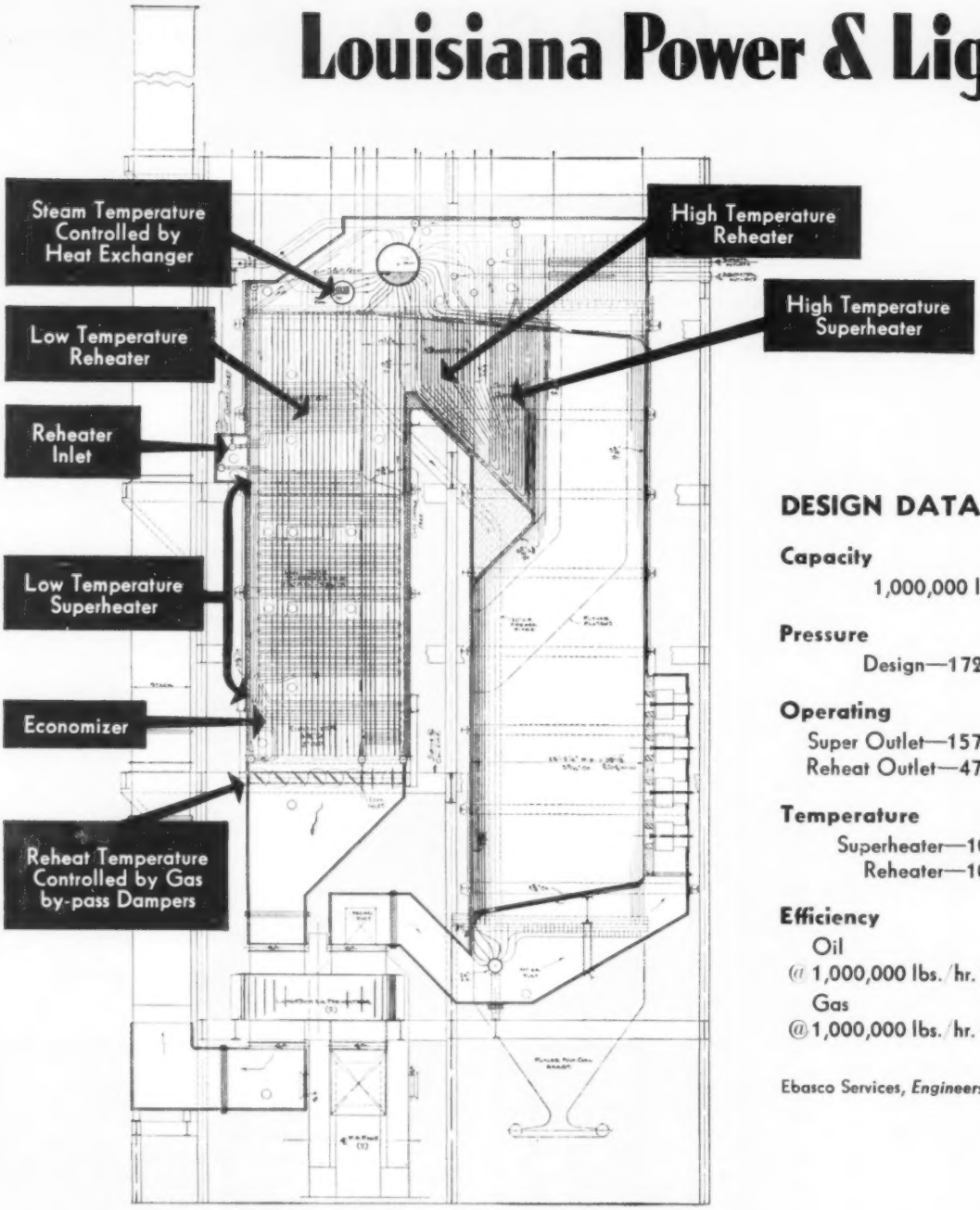
Louisiana Power & Light



DESIGN DATA

Capacity
1,000,000 lbs./hr.

Pressure
Design—1725 psig

Operating
Super Outlet—1575 psig
Reheat Outlet—470 psig

Temperature
Superheater—1005°F.
Reheater—1005°F.

Efficiency
Oil
@ 1,000,000 lbs./hr. 88.1%
Gas
@1,000,000 lbs./hr. 84.2%

Ebasco Services, *Engineers*

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston Cincinnati New York Charlotte Philadelphia Atlanta Denver Washington New Orleans Salt Lake City Buffalo St. Louis Los Angeles Pittsburgh Kansas City Portland Cleveland St. Paul Seattle Detroit Tulsa Chicago Houston

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • ECONOMIZERS

first to use Reheat with Natural Gas

Louisiana Power & Light Company's 1,000,000 lbs./hr. pressure furnace Riley Reheat Unit will be the first reheat unit fired by natural gas and oil to be installed by the Public Utility industry.

Several features of Riley Unit for Louisiana Power & Light Company

Separate Independent Control of Superheater and Reheater Temperatures.

Maintenance of desired superheater and reheater steam temperatures is obtained by different and independent controls so that an adjustment to the temperature of one does not effect the final temperature of the other. Reheater temperature is controlled by varying the quantity of gas passing over the low temperature reheater sections by means of dampers beyond the economizer. Superheater temperature is controlled by means of a heat exchanger which regulates the temperature of steam entering the high temperature superheater section so as to give the desired superheater outlet temperature over the desired load range.

All Tubes Welded to Stub Tubes. *No Rolled Joints.*

All tube connections to drums and headers of boiler, water walls, superheater and economizer are welded, not rolled and merely seal welded. Stub tubes are shop welded into drums and headers prior to shipment for field weld of tubes thereto.

Furnace Pressurized. *No Induced Draft Fans.*

The unit is a pressurized furnace unit operating with forced draft fans only. The furnace will operate under a pressure of approximately 7.25″ of water. The use of a pressurized furnace reduces over-all fan power requirements and increases efficiency because of lower excess air.

A Few Recent Riley Units for Public Utility Plants

DEPARTMENT OF WATER AND POWER
CITY OF LOS ANGELES, CALIFORNIA
1,200,000 lbs. hr. 2075 psig, 1000°F. and 1000°F. reheat.

LOUISIANA POWER & LIGHT CO.
1,000,000 lbs. hr. 1725 psig, 1005°F. and 1005°F. reheat.
Ebasco Services, *Engineers*

HOUSTON LIGHTING & POWER CO.
1,200,000 lbs. hr. 1700 psig, 1005°F.
Ebasco Services, *Engineers*

SOUTHWESTERN GAS & ELECTRIC CO.
630,000 lbs. hr. 1050 psig, 1005°F.
Sargent & Lundy, *Engineers*

MONONGAHELA POWER CO.
700,000 lbs. hr. 1050 psig, 905°F.
Sanderson & Porter, *Engineers*

UTAH POWER & LIGHT CO.
575,000 lbs. hr. 1700 psig, 1000°F. and 1000°F. reheat.
Bechtel Corp., *Engineers*

CENTRAL ILLINOIS LIGHT CO.
600,000 lbs. hr. 950 psig, 900°F.
Commonwealth Services, *Engineers*

NORTHERN STATES POWER CO.
385,000 lbs. hr. 1500 psig, 950°F.
Pioneer Service & Engineering, *Engineer*

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY
460,000 lbs. hr. 1025 psig, 900°F.
Ford, Bacon & Davis, *Engineers*

THE POTOMAC EDISON CO.
700,000 lbs. hr. 1050 psig, 905°F.
Sanderson & Porter, *Engineers*

IOWA ELECTRIC LIGHT & POWER CO.
300,000 lbs. hr. 975 psig, 910°F.

GULF POWER CO.
325,000 lbs. hr. 1000 psig, 900°F.
Southern Services, *Engineers*

SOUTH CAROLINA GAS & ELECTRIC CO.
400,000 lbs. hr. 1475 psig, 955°F.
Gilbert Associates, *Engineers*

UTAH POWER & LIGHT CO.
620,000 lbs. hr. 1500 psig, 955°F.
Bechtel Corp., *Engineers*

IOWA-ILLINOIS GAS & ELECTRIC CO.
250,000 lbs. hr. 975 psig, 905°F.

PUBLIC SERVICE CO. OF INDIANA
400,000 lbs. hr. 1000 psig, 910°F.
Sargent & Lundy, *Engineers*

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

Before you buy an Expansion Joint

Read this!

Anyone in industry today recognizes those compelling factors which cause "purchase by price".

What is not so easy to see is that the "lowest price" is certainly no indication of the *value* of a product—no matter what it is!

That is why Zallea Expansion Joints—even though maintaining a competitive price position in their field—*guarantee performance* and *quality*. These characteristics are built into every Zallea Expansion Joint which has ever left our plant—and are measurable in dollars and cents by any industrial buyer.

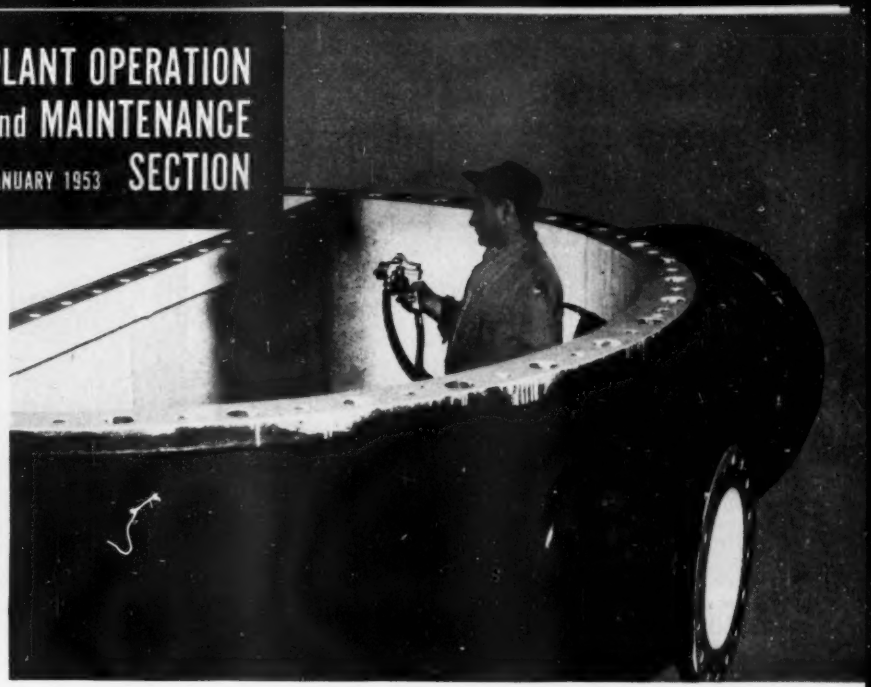
You will find—as have thousands of others—that the value of a Zallea Expansion Joint is in direct proportion to its service life. The proof? *Repeat orders* from customers *by the hundreds* in the last quarter of a century.

Before *you* buy an expansion joint, check *first* with a Zallea Representative for *proof* that your best buy is Zallea. There's no obligation, of course. Zallea Brothers, 814 Locust Street, Wilmington 99, Delaware.

Catalog 47 and Bulletin 351 describe the complete line of Zallea Expansion Joints and Flexible Connectors. Write for copies today.

Zallea
EXPANSION JOINTS

WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS



SPRAYING primer coat on pump impeller **FIRST** of 40 coats, No. 1460 neoprene sprayed over primer inside condenser waterbox

Pad With Neoprene to...

Save Critical Parts

...From Corrosion and Wear

Starting on this page, every article in this Plant O & M Section directly concerns

MAINTENANCE

Tied to the theme of the 4th Plant Maintenance Conference in Cleveland, Jan 19-22, subjects cover the waterfront for power engineers on: corrosion, diesel crankshafts, pumps, electricity, refrigeration, heating, boiler-room pointers, fuel tanks—plus the usual maintenance shorts

► SYNTHETIC COATINGS are going into high gear to save surfaces of costly power-plant equipment. Is it practical, you ask? Well, we saw a 70% nickel-alloy pump impeller, photo above, worth $4000, shipped a long distance by one manufacturer just to be coated. Then it was returned to factory for assembly. We saw a 16-ft-diameter condenser's waterboxes, above, shipped to same shop for coating by another maker. Cost of shipping alone is a major expense.

We also visited utility plants where this same firm coats everything from condenser tube-sheets to traveling inlet-screens. But in these cases work is done by firm's highly skilled traveling crew.

Development. Synco Corp of Emmaus, Pa. is headed by its founder, Bill Sesher. He turns out "engineered coatings," and stands back of every job.

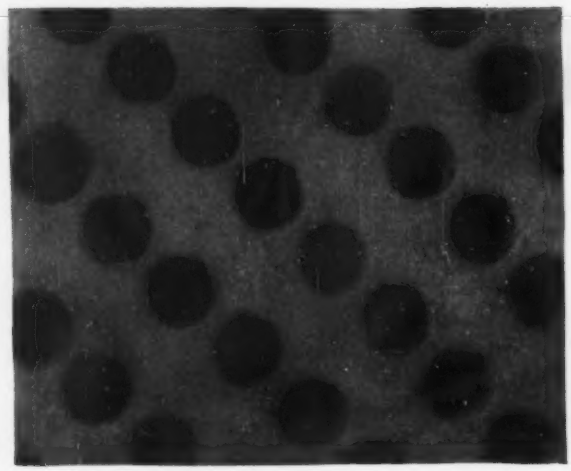
When starting his firm a few years ago, Bill made good every job not proving entirely satisfactory. Today, he's perfected techniques and trained his crew so failures are uncommon. First, he requests blueprints and data of parts to be coated. After studying corrosion and wear problems, he outlines sections to be coated on blueprint. Then he indicates coating material, thickness of coating and procedure for doing job.

Large manufacturers and utilities send work to Sesher faster than he can do it—or they have it done to installed equipment on the spot. Talk about building that better mouse trap.

Sesher's ace-in-the-hole is his patented primer. Ingredients are secret. Primer works so well that firm coats moving parts, such as induced-draft fans and pump impellers, and stationary parts that take heavy abuse.

Parts to be coated are first sand-blasted. Primer is then applied. After primer, as many as 40 coats of neoprene are brushed or sprayed on. Coated part is then baked for thorough curing.

(More on next page)



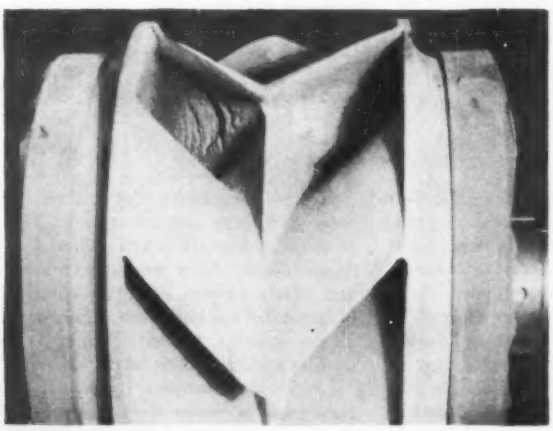
BEFORE Sandblasted tube sheet and tube ends show why big condenser leaked brackish water into steam

AFTER Instead of replacing 17,800 tubes, 1/16-in. neoprene covers tube sheet; inside tube 6 in. from ends

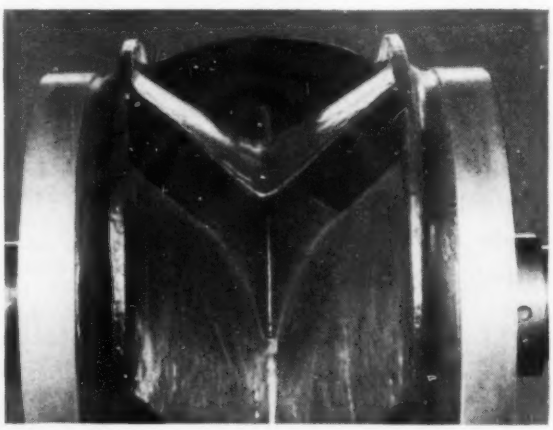
Condenser Tubes and Tube Sheet Are Rescued From an Untimely and Needless Death

Thirteen years of tough service have eroded injection ends of these tubes to less than 0.010-in. wall thickness in some places. Leakage in condenser was excessive. In 42 hours, ends of 17,800 tubes were coated with a special neoprene. That reestablished original tube-wall thickness to six inches back from tube ends where they were eroded. Tube sheet got 1/16-in. coating also.

At same time, tube-sheet gasket, between tube sheet and waterbox, was sealed. Coated job has been in service and there is absolutely no leakage now. So coating has solved two very expensive problems. This condenser will give many years of life with same old tubes and tube sheets, saving costly outage.



BEFORE Cavitation eroded this 24-in. raw-cooling-water pump impeller after only 9 months' normal service



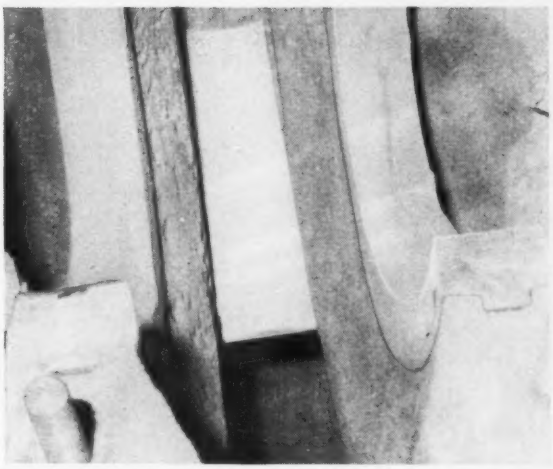
AFTER Same impeller rubberized with 0.035 in. film after cavitated areas were filled to reestablish contours

Pump Impeller Saved From Early Grave

This 24-in. impeller of raw-water-cooling supply pump is badly cavitated after only nine months' service. All vanes are eroded in same way. After sandblasting and priming, depressions were filled and leveled off to re-establish contour of each vane. Doing this job right makes difference between failure or success of coating job.

Then impeller was coated with 0.035-in. film of neoprene and cured in drying room. Repaired pump has been running since June 1949, and there is no indication of cavitation.

Film thickness is so well-controlled that impeller is balanced the same as before. Each layer is a different shade to make sure of covering entire area.



BEFORE Copper plate replaces 7 in. of receded tongue in this circulating pump before coating with neoprene

AFTER Here 0.090 in. neoprene covers eroded, built-up parts. Job cost $1000. New pump's cost: $30,000

So Is This Old Worn-Out Centrifugal Pump, Saving Owner a Fat $29,000 Bill

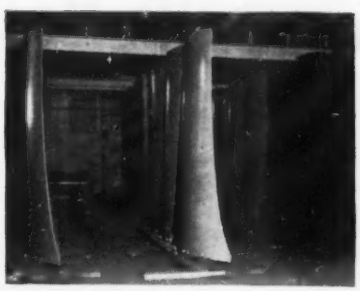
This large circulating pump is badly eroded from long use. Cut of tongue has receded 7 in. As shown in left photo, it was first repaired with copper plate, held with countersunk screws.

Sealing ring seats were also badly eroded, so new ones were installed. Photo shows them covered with tape to save being covered with neoprene.

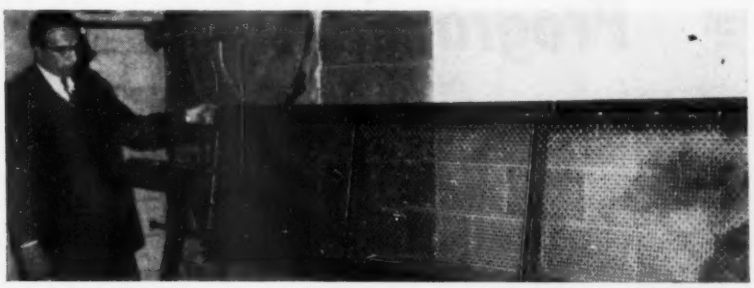
With stage set for coating, 0.090 in. of No. 1460 neoprene covers eroded and built-up parts. Because of unusually tough service, neoprene in this pump is reinforced with glass cloth.

Total cost of salvage job was only $1000. New pump would cost $30,000. Chances are coating will hold up many years, doing work of another new pump.

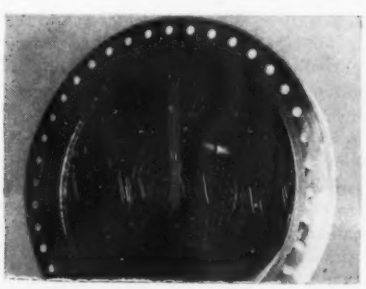
Other Repairs for Power-Services Equipment



COOLING-TOWER fan blade weighs 200 lb; 18-ft diam; balance must be perfect

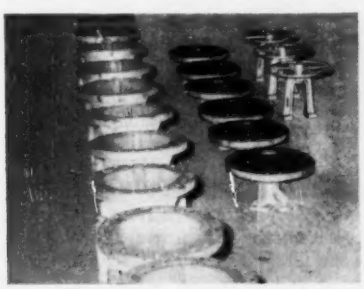


TRAVELING SCREEN and frame being inspected by Bill Sesher after coating with neoprene. Bare steel lasted one year, expected life of this coated job is 10 years

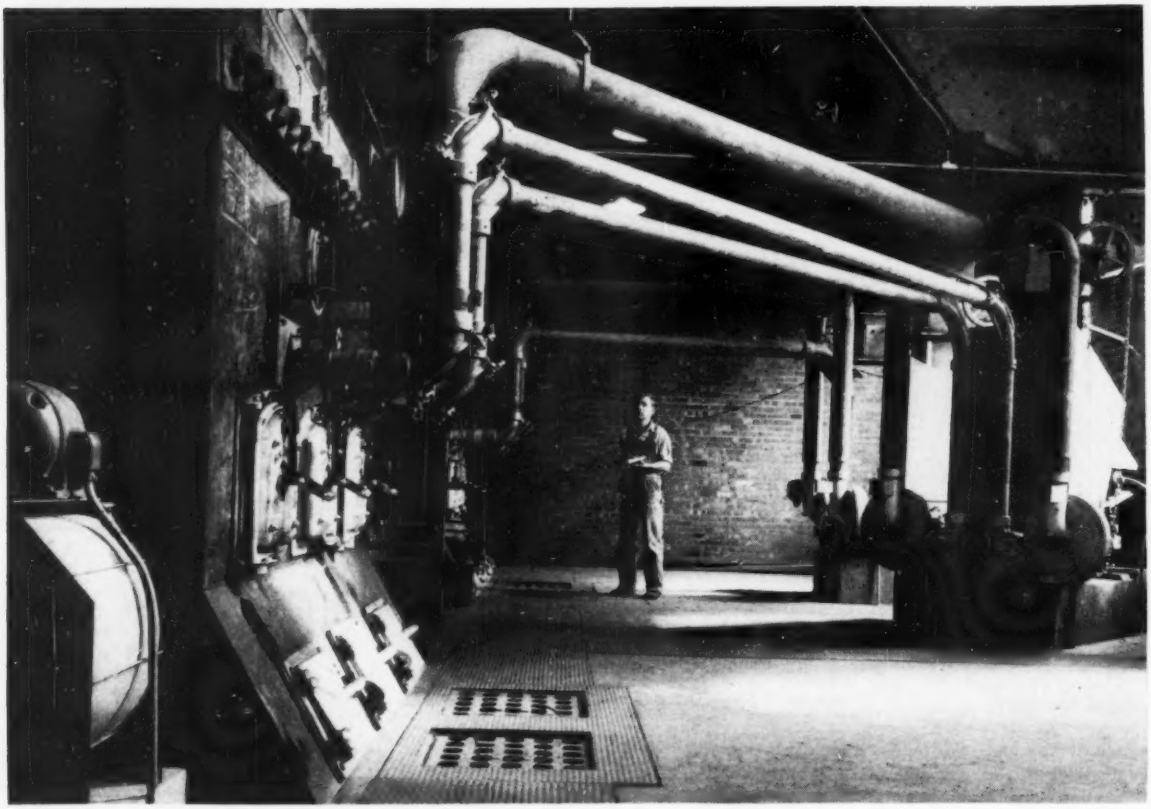


HEAT-EXCHANGER head has strainer plate; a 0.035-in. film prevents corrosion

LARGE BLOWER'S inside is coated so it works in 12% of sulfuric acid fumes



STEEL VALVES are 24 in. diameter, and will last long with inside surfaces coated



MAINTENANCE of boiler-room equipment is a never-ending job that requires intelligent personnel plus sound management

Programing: Surest Way to Better

► A LOT OF BRAINS, years of experience, or a good system—any one of these equips a plant engineer to ride hard on boiler-room maintenance. The easiest of the three to come by is a good system.

You'll find the simpler the system, the better the results. So set up a program like that outlined on the facing page and you're off to a good start. This outline involves only keeping enough in records and notes to give you ready knowledge of your plant's equipment and the job each piece performs. It's the basis of sound judgment for either operation or maintenance.

Set up a file for manufacturers' data on the equipment you've got installed around the boilerhouse. A lot of it you'll need only for major overhaul or replacement work. Some of it you'll want for a guide in establishing operating and preventive maintenance procedures. Pick this out and work it into your operating or maintenance crew assignments. But still other information like parts' numbers for grate keys, arch refractory, water columns, etc, ought to go on easy-to-get-at cards in an active file that you key to individual equipment records.

These last records should carry nameplate data like operating pressure, size as well as location, service piping and wiring, controls. We've seen one crackerjack idea. It's an equipment log or data book that features, for single pieces of equipment, the operating history, costs, repair and maintenance data, even names of mechanics performing repairs, parts replaced, operating time, down time, in fact, all pertinent information. The man using this log says it's a preventive maintenance tool. With it he's been able to show how certain instruments and controls can avoid breakdowns.

Schematic Drawings. Another mighty helpful record, especially when it comes to shooting trouble on boiler auxiliaries, is schematic drawings. If you can go to a file and pull out a sketch, as simple as possible, on how combustion-control equipment works, you can usually tie trouble symptoms to a part of the control. In fact, with this approach, you'll find you can develop one of your maintenance crew into a first-class meter man.

But auxiliaries aren't the only part of your power plant that can profit from schematics—piping, wiring should be included. They serve as a good check point for identifying and correcting persistent troublemakers like poor trap sizing, inadequate valving.

Contract File. A third file setup we've found helpful in a maintenance program is one carrying service and supply contracts and orders. They furnish an excellent guide in figuring expected maintenance costs for budget work, as well as in balancing services supplied against the offers of competitive suppliers.

Operating Routines. One good main-

BASIC FACTS FOR GOOD PROGRAM CONTROL

RECORDS...

Plain or fancy, they're the most essential single prop of a continuing maintenance program. In their barest essentials they should cover all your equipment, prove the basis for alterations or replacements, provide the clincher with management.

CONTRACT FILES...

Properly kept, they are your control over outside equipment or service suppliers. They remember where one contractor falls down, another is strong. Often they are potent aids in bargaining, show management, contractors origin of past errors.

PLANT SCHEMATICS...

Simple, single-line drawings that picture the vital lines of service to and through your boiler room. They serve as the starting point for employe training, either operating or maintenance. What's more, they help you in isolating trouble.

OPERATING ROUTINES...

Frequently there's no dividing line where operation ends, maintenance begins. Much of your routine maintenance can be made part and parcel of regular operation and logged that way. You'll find it's sure way of getting jobs done.

INSPECTIONS...

Set up on a periodic basis, with a systematic approach, it's a quick check on maintenance-program effectiveness, overlooked needs, plot of future trouble.

Boiler-Room Maintenance

By DONALD WOOD
Allentown, Pa.

tenance lesson you get from long experience is the value of sensible operating routines. We firmly believe that the line between operation and maintenance often doesn't exist at all. Good operation is good maintenance. Daily blowdowns and water tests are one example. Weekly routines, like filling surge tanks, inspecting out-of-service boilers and lifting safeties by hand, monthly jobs like cleaning sumps, changing crankcase oil, seasonal assignments like draining exposed lines can all be handled by an operating crew but are largely of a maintenance nature.

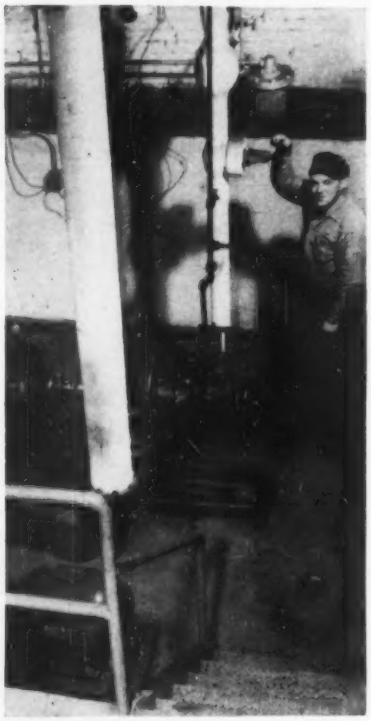
Costs. Just as soon as you can, establish an estimate of the cost of all power services. Put this estimate on a unit cost basis, such as cents per kwhr or Btu, or lb of steam, and then compile total annual costs. The unit-cost figures let you compare your results with similar industries and with past performances. If costs begin to climb, you'll want to have a reason that makes sense. Annual cost figures play a large part in your company's profit and loss statement.

Inspections. One thing you've got to do yourself: that is, make periodic physical inspections of your plant. Make them thorough, detailed. You'll uncover a lot that needs fixing. Draw up an itinerary—that is, lay out your plant by areas and schedule your inspections, say, once a month. Pull out your equipment cards for the machines you've got in each area, familiarize yourself with their data. Then draft an inspection report listing your findings for areas month after month. It will give you a ready check on what's been left undone, what progress you're making.

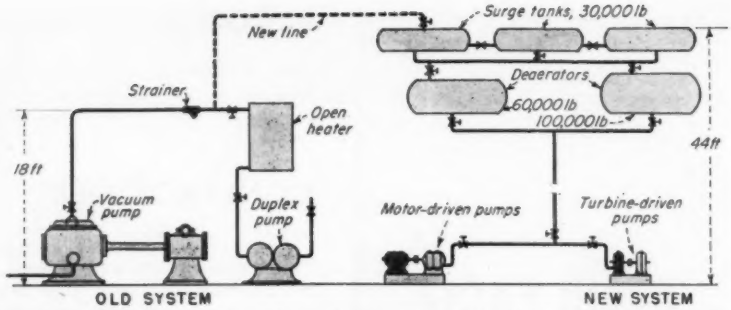
Behind every step you take in the boiler house, operating or maintenance, should be the recognition that you're running a service organization. It ought to be apparent in a nice balance between economical operation, on one hand, and relative freedom from interruption, on the other. Any time you have a breakdown it should be the result of an explainable, calculated risk.

Often when a new man takes over a boiler room he tends to go head-over-heels into a fix-up, clean-up program. That's all right for the obvious, but be sure every change is based on the boiler room's role as a service organization.

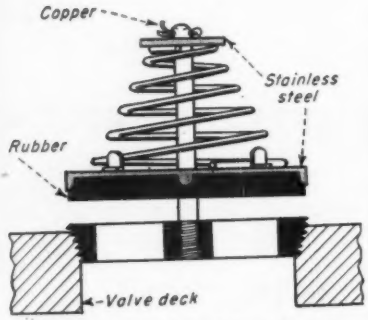
Then on the matter of housekeeping. Many old-timers were champions of the spit-and-polish school of keeping a boiler room in shape. You can carry this idea too far. If plant management believes the powerhouse ought to be a show place, as may be the case for a dairy, all well and good. Be certain you let the decision be management's. Your prime concern must be service. It's far better to have valves that seat well, steam lines free of water hammer, ample provisions for pipe expansion and contraction than to have shiny, nickel-plated valve handles, steam-line fittings frozen from unwise paint application.



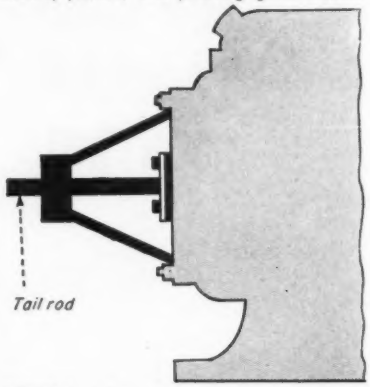
TURBINE-DRIVEN feed pump is standby to work with the electric-driven pumps



NEW FEED SYSTEM created problems when it was tied in old system with lower head. With increased load on simplex pumps, cylinders, pistons and packing gave trouble



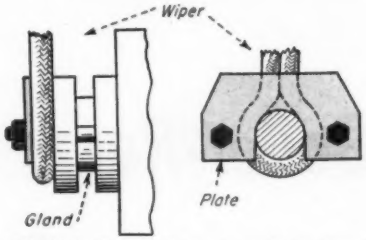
RUBBER valve disk reinforced with a stainless-steel plate lasts much longer



LOAD is taken off liquid piston by this tailrod supported through cylinder head

Old Feed Pumps Work Like New

By **ED DUFF**, *Aurora, Colorado*



WIPER held by plate on packing gland keeps piston rod oiled, cuts down wear

► SEVERAL YEARS AGO we improved our boiler-feed system. The old setup had simplex vacuum pumps, open heater, and plunger outside-packed duplex-pumps. The new system at first had a 60,000-lb-per-hr deaerator and three turbine-driven boiler-feed pumps. Later, an electric-driven pump and a 100,000-lb-per-hr deaerator were added as shown.

Big question was whether we would have to add a new receiver tank and pump to send water up to surge tanks. After figuring, we found vacuum pumps could do job, but with a loss of some vacuum in system. This seemed all right till we ran into other troubles from this change.

Because of greater head, vacuum pump piston pressed harder against the sides of water cylinder lining. That increased wear of packing and wore bronze sleeve rapidly.

To remedy, we removed the piston rod and had a new one made with a long tail. We then made an angle tailpiece support with bronze bushing. A packing gland was worked into the rear head, making this a balanced-piston pump. These pumps (we now have three) lift the water to a height of 44 ft. They also hold a good vacuum since making the change.

To further increase efficiency, we experimented with rubber valve seats to decrease wear and increase pumping. Hard rubber chipped and broke, carrying valve pieces up to deaerator. Pieces got into automatic control valve. With soft seats, wear was rapid at stud from valve action.

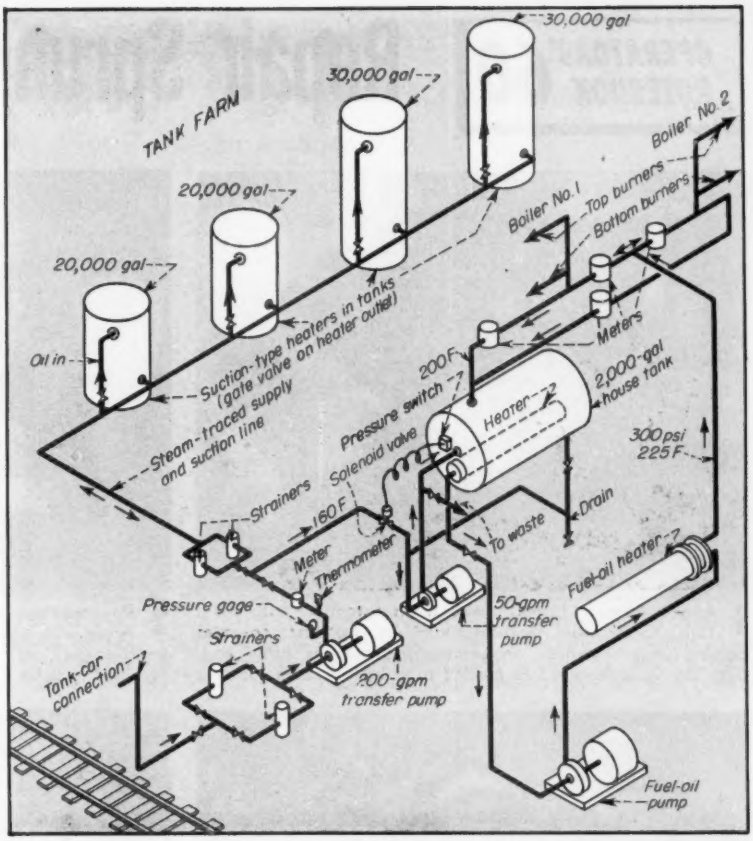
We now use soft valves with a retaining disk, built as shown, of stainless steel. This is a fairly expensive metal, but we make a direct saving as scraps of it are left from the construction of surgical and kitchen tables. Cotter pins are copper wire to resist corrosion of return condensate.

We also used an old marine and railroad idea on this pump. It's a wiper on the piston rod. For this, we use wicks of type used on construction flares. These are about ¾ in. thick and 12 in. long, and can be cut for several wipers. By using a plate cut as shown, and locking it between packing stud nuts with other nuts on outside, wiper is held close to piston at the packing gland. By keeping this well-oiled with mineral oil, life of packing has been more than tripled. This means less packing, less labor, less shutdown time than before.

Sludge in fuel-oil storage tank can triple your maintenance woes, send costs up. See how good planning, simple equipment solved plant's tough fuel-oil sludging conditions

Smart Setup Chases Fuel-Tank Sludge

By L W FITZPATRICK,
Chief Engineer
Dept of Corrections, Jefferson City, Mo.



TANKS AND PIPING in this fuel system were planned for sludge-free service. House tank is heart of layout. In it hot oil mixes with the cooler oil from the storage tanks

► OUR PLANT rolled for years, turning out heating steam without a hitch in the No. 6 fuel system. Then, bang! About a year ago, all tanks sludged up. Over two million gallons of oil had passed through them.

Cause of Sludge. Refinery supplying our oil switched from thermal cracking to modern catalytic crude cracking. New system gives a residual fuel with higher Btu and more sludge.

I've also heard of plants, in oil-short areas, getting No. 6 oil, having heavy sludge. If oil were plentiful, this sludge would be dumped to waste, but today it must be burned to keep plants on the line.

Fuel Tanks. Sludge from our new oil was so bad, and would continue that way so long, we converted our underground tanks. We dug them up and put them in the tank farm, sketch.

Railroad tank cars bring us oil. Cars have two oil connections, one at bottom, another at dome. After mounting the fuel tanks above ground we raised tank-car connection so we pull oil from dome outlet. This prevents our getting some sludge from each car emptied, as we would with lower outlet.

Piping. Single steam-traced line feeds oil from cars to tanks. House tank, like a day tank, stores oil while main tanks are being filled. When they are full, flow in main feed line reserves, and 50-gpm transfer unit pumps oil to house tank. Here it mixes with excess oil returned from burners.

Heaters. Each fuel tank has one 250-gph suction-type oil heater that raises oil temperature from 0 to 160 F. In house tank this oil mixes with 200-F oil returned from burners. Steam is saved because oil on its way to burners picks up heat that would otherwise be wasted. Between 25 and 35% of the oil entering tank is at 200 F.

Control. Solenoid valve in 50-gpm transfer-pump suction is actuated by house-tank pressure and is interlocked with pump motor. At preset pressure, valve shuts and transfer pump stops. Fuel-oil pump runs continuously, supplying oil to burners on boilers. Pressure-relief valves on pumps give protection against excess pressure.

Remove Sludge. When sludge builds up in house tank, 50-gal transfer pump discharges it to waste. Or this pump can recirculate sludge and oil to agitate the mixture. When enough oil mixes with sludge, the two burn easily.

With our main storage tanks above ground it is easy to drain sludge from them to waste. Tank heater raises sludge temperature so it flows easily. We regularly take sludge samples from house tank for analysis.

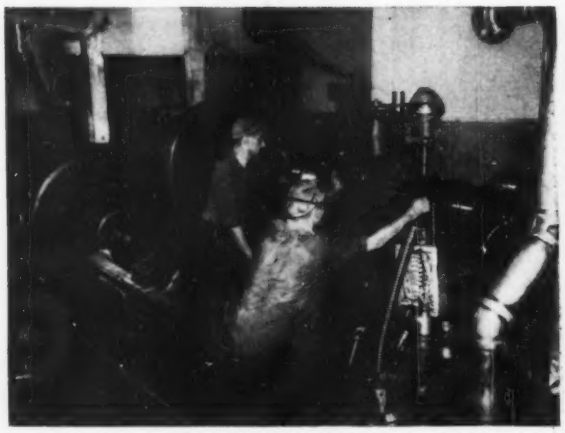
Results. Besides curing our sludge troubles this system has stopped moisture condensation in outdoor tanks. Oil at 200 F returning to house tank from burners doesn't have a chance to cool. To be safe our system still uses a fuel-oil additive to dissolve small amount of sludge that builds up.

Why Additives? Not every plant can change its tank layout to stop sludge. Fuel-oil additives, used while sludge accumulation is small, give good results. Additive helps distribute sludge through whole tank so mixture can burn.

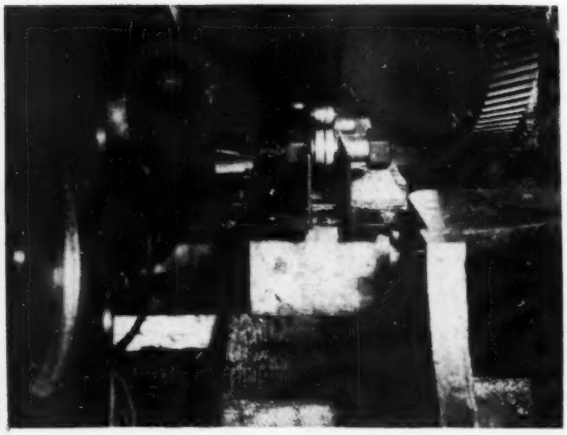
Never use additive before testing it on sample of your fuel-oil sludge.

OPERATORS' NOTEBOOK 60

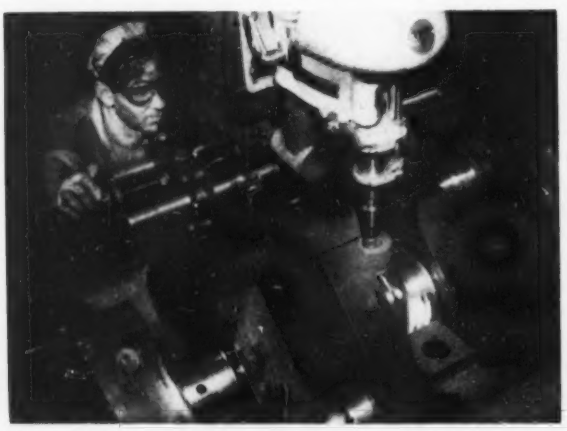
Repair Sprung Crankshaft



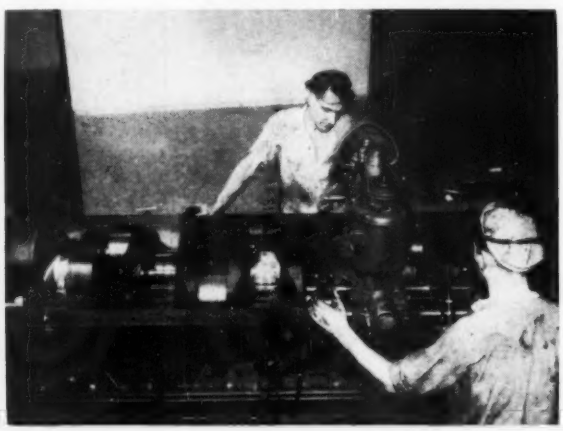
1 Engine frame is turned upside down onto floor with chain falls. Crank (with flywheel shrunk on end) rests on roller bearing under flywheel, on bearing shell at the other end. Grinding rig is fastened to casting to grind the main journals



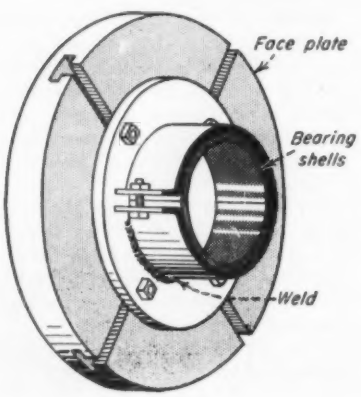
2 Ball bearings are held between angle irons with bolts. Angle iron is blocked up and shifted so crankshaft is centered exactly through main bearing spaces in engine frame. Flywheel is used as bearing as it must run true, not wobble

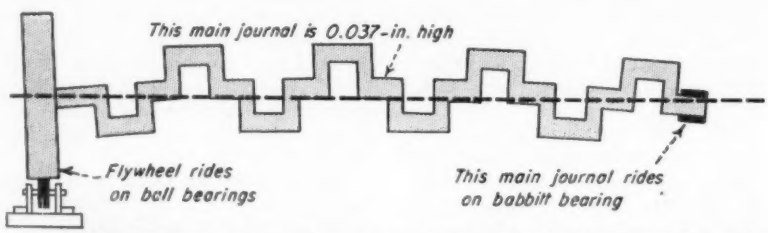


5 Oil holes in crankshaft are plugged tightly with rags to keep out grit. Main bearing shells are removed from all but the last bearing so warped crankshaft swings freely and is ground true. Here the operator feeds the grinder manually



6 Motor turning crankshaft is controlled by Mr Liefke in front of grinder. He also adjusts depth of grinding cut. Operator in back feeds grinder across shaft between crank webs. He also moves grinding rig from one crank to another



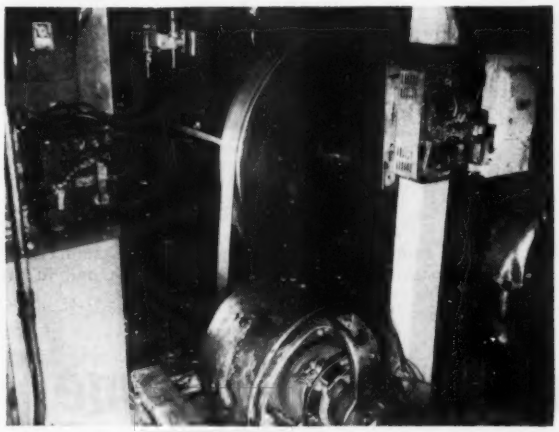


CRANKSHAFT is supported on two extreme ends by ball-bearing rollers under flywheel and main bearing-shell under journal while grinding sprung shaft

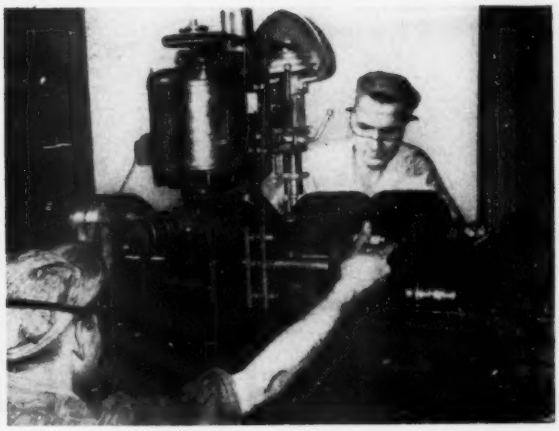
BORING RIG is bolted to face plate and bored true to outside of newly cast babbitt shells. Bolt clamps shells tightly. Not necessary to true each set

In Place and Save $ $ $

By STEVE ELONKA, *Associate Editor*

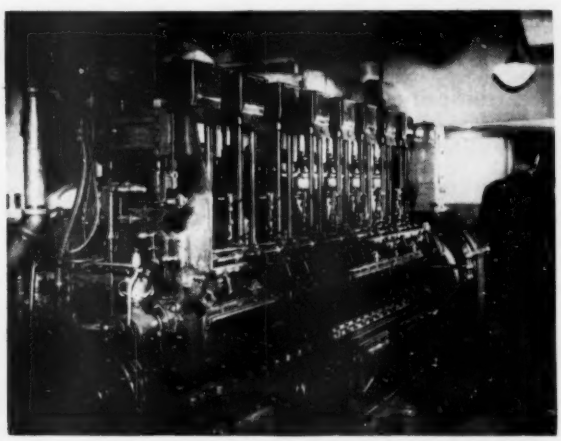


3 Spare motor with small pulley is lined up under flywheel. Motor starter is connected, belt fitted around flywheel to motor pulley. Engine frame is well braced with timber so job is rigid. Crankshaft is checked again for being centered



4 Grinding rig is highly flexible. It can be bolted in place for each main bearing. There is adjustment to hold spindle of wheel truly perpendicular, another to move grinder across shaft. Feed screw moves wheel along shaft as it grinds

7 With all the main bearing journals ground, two assistants polish each journal by wrapping long strip of smooth grinding cloth around journal and pulling back and forth. It took a few days to polish eight main journals to a bright finish



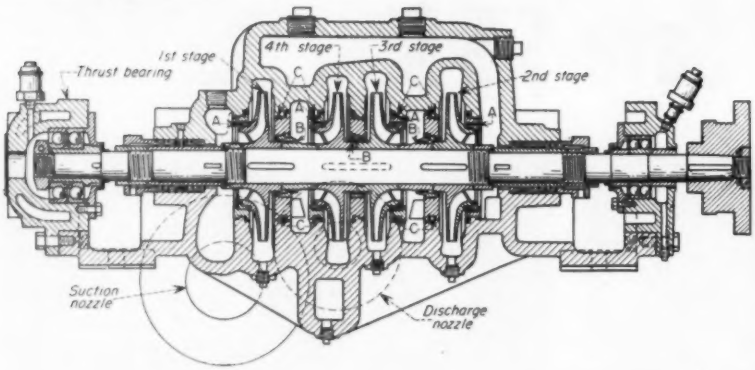
8 Newly poured bearing shells were bored to size of each journal in plant lathe. Shells slid under journals and engine frame swung back onto its bed. Engine assembled, deflection test was made between webs. Engine running here

Crankshaft Rides in Upside-Down Engine Frame While Being Ground True

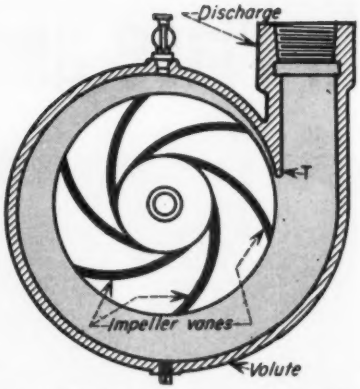
► THE NIGHT ENGINEER started this 10x12 460-hp 600-rpm 4-cycle diesel engine without starting separate lube-oil system. After a few minutes lights flickered and engine was stopped. Babbitt had flowed out of some main bearings and crankshaft had sprung 0.037 in. near center.

Flywheel is shrunk onto crankshaft. Removing it from basement plant would have been costly. Job was given to R O Liefke, Brooklyn, N. Y., who sells and installs diesels. He did job on spot by turning engine frame upside down, resting crankshaft in place. He supported sprung crankshaft at one end with main bearing shell, under flywheel with ball bearing rollers. He removed all main bearing shells but last one, and revolved crankshaft with belt around flywheel, while grinding.

Each main bearing journal was ground true with grinder rig attached to housing. Then polished smooth with long strips of grinding cloth. Only enough was ground off each journal to clean it up. New set of babbitt shells were cast and fitted to each journal. Deflection test showed cranks within permissible tolerances (see Operators' Notebook 45, Sept 1951). Besides saving money, engine was back in operation in record time for peak loads.



1 Wear in the running-joint clearances, as between wearing rings at *A* and stage pieces, *B*, increases the leakage from pump discharge side to the suction side



2 If the tongue *T* in a volute casing is worn uneven, smooth and fair it

Overhaul That Pump at Right Time

Which is better? Pulling a pump apart once a year to see if it's in good condition or letting it run until trouble shows up? There's more than one answer to this important question. Here one authority tells you what he thinks is the best for your plant

By W E W JONES

► ENGINEERS DON'T AGREE on how often you should completely overhaul a centrifugal pump. That's because it's almost impossible to set up general rules applying to all classes. Design of unit, service it's used for, kind of liquid handled, construction materials, overhaul cost, and power saved by replacing worn parts—all enter the decision of when a pump should be opened for inspection and repair.

Overhaul Schedule. Some pumps in severe services may need a monthly overhaul; others need be opened only every two or four years, or even less often. So a schedule for inspection and repair of pumps in one service may not suit those in another.

But, in general, a centrifugal pump need not be opened for inspection unless evidence shows overhauling is necessary. This means a decrease in pump performance, too much noise, or driver overload shows you have trouble. This isn't the whole story; we'll look at exceptions later.

Instruments. You need the right instruments and meters to run medium- and large-size centrifugal pumps successfully. They also help increase pump life. You must be able to find capacity and discharge pressure if you expect to have a good maintenance program.

Set up a schedule for testing each unit. Compare the test results with performance figures for the pump when it was new. These tests, and not a fixed period of service, should tell you when a pump needs overhaul. Testing a unit costs less than opening it for inspection, and unit doesn't have to be taken off the line.

Pump Performance. Let's see what effect internal wear has on centrifugal pump's performance. We'll assume its impeller delivers the same gross capacity at any given head. But pump has internal clearances at running joints, like those between impeller and casing wearing rings, *A*, and stage pieces, *B*, Fig. 1.

Leakage occurs through these joints and all fluid discharged by the impeller does not go out the pump discharge. Some of it leaks back to the impeller suction eye. Net capacity of the pump is the difference between gross discharge and internal leakage. In a new unit, leakage may be as low as 2% so the net capacity is 98% of impeller discharge.

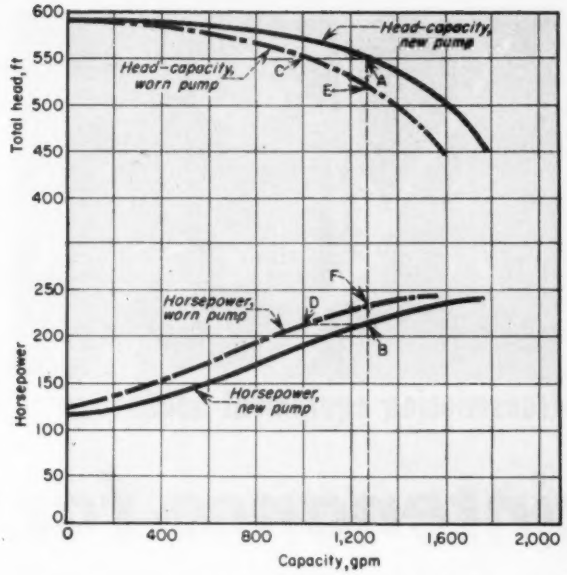
But after pump is on the line awhile, running clearances wear and internal leakage or short-circuit losses increase. This reduces the net capacity of the pump for a given total head and horsepower. If we want the same net capacity from the pump, total head on it must be reduced. Horsepower input increases.

Head Capacity. Horsepower and head-capacity curves, Fig. 3, show how internal leakage affects centrifugal-pump performance. When this pump is in good condition it delivers 1270 gpm at 550-ft head, point *A*, and needs 215 hp, point *B*.

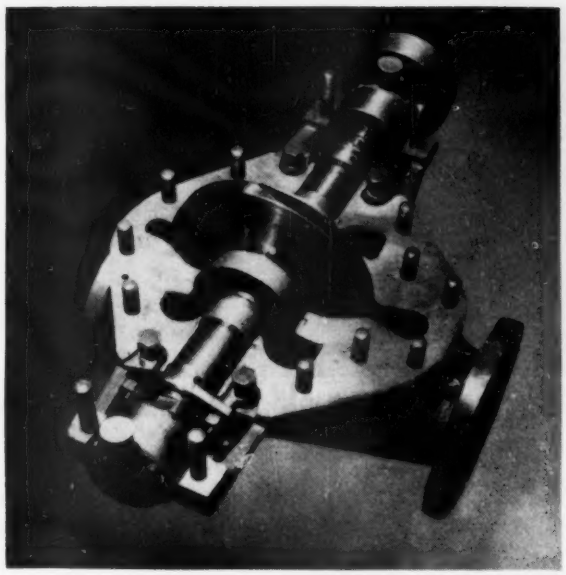
After the running clearances wear, leakage through them increases to where pump can deliver only 1000 gpm at 550-ft head, point *C*. Horsepower input remains the same, 215 hp, point *D*. You would expect this because the impeller delivers the same gross capacity under the same total head in both cases.

If you want the same capacity, 1270 gpm, under both conditions, then the total head against which the pump runs must be reduced. For the worn pump to deliver 1270 gpm, total head must be reduced to 520 ft, point *E*; power input increases to 235 hp, point *F*. If you test pump regularly, you'll get a reliable picture of internal-clearance condition.

Operating Experience. Information from past use of a given pump or a similar one can serve as a guide for when it needs opening. For instance, assume you have several boiler feed pumps that ran 50,000 hr without needing an overhaul. That's enough evidence



3 Head-capacity and horsepower curves show how increased leakage will affect the performance of a centrifugal pump



4 Complete overhaul of a split-casing pump should include careful inspection of the horizontal flanges and gaskets

that similar units need not be opened for inspection until they've run 50,000 hr.

On the other hand, pumps on severe service may need an overhaul every three months. To get longer running periods you can replace the pump with one built of better materials or of sturdier construction. But until new equipment proves itself in service it's best to open it at the end of three months to find out how the better materials stand up.

Big Plants. It isn't wise to advise public utility operators to neglect having an adequate inspection schedule. They generally have spare pumps and plant won't be shut down if one fails. But during the last 10 years, at least 75% of utility-plant operators have had to judge pump condition by outside signs and instruments because of plant overloads.

Keep enough spare parts on hand when running an overloaded plant. Then if a pump fails, you can overhaul it quickly. This avoids possible delays in getting needed parts from the builder.

Check the Pump. Whether you do or don't open pump for inspection, make these scheduled checks. At least once every six months check pump and driver alignment and correct if necessary. Inspect stuffing-box packing. Drain oil-lubricated bearings; flush and refill. Check amount and condition of grease in bearings. Make as accurate a test of the unit as you can with the instruments you have on hand.

Besides the 6-month inspection, make a more complete one once a year. Take out bearings and inspect them for wear and defects. Repack stuffing boxes unless experience shows you the packing can safely go for a longer time. On horizontal pumps with sleeve bearings, remove the packing and open coupling.

Check vertical movement of shaft at each end. Restore bearing clearance if it is more than 150% of the original. That is, if the original clearance was 0.002 in., recondition or replace bearing when wear increases its clearance to 0.003 in.

Opening the Pump. Dismantling a centrifugal pump is usually done to inspect internal surfaces and running clearances. This should show if materials are suitable for the liquids handled. If you find small pits or erosion on the casing, you may be able to fill these by welding, brazing, silver soldering or metal spraying. Examine all metal-to-metal fits, such as where casing rings fit into the casing, as at *C*, Fig. 1.

If the tongue or cut-water *T* in volute casings, Fig. 2, is worn uneven, cut it square across, and file it round and smooth. Horizontally-split casing pumps, Fig. 4, must have damaged gaskets between top and bottom halves replaced before reassembly. Be sure new gasket is the same thickness and material as the original one.

Check clearances between all running joints, as between casing and impeller wearing rings, *A*, stage pieces and impeller hubs, *B*, Fig. 1. When these clearances increase 100 to 150%, replace worn parts or renew their surfaces.

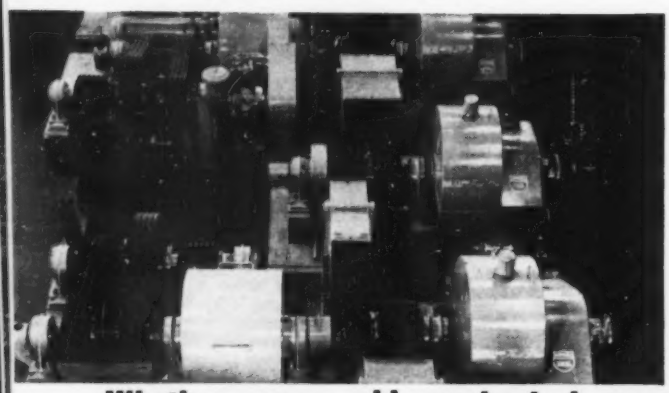
While you have a general-service pump open, clean and paint casing waterways. If you work on shaft sleeve, check its concentricity after tightening it in place. Pump size, sleeve material, and size of your repair shop must all be taken into account when deciding if it's cheaper to install new shaft sleeves or resurface old ones.

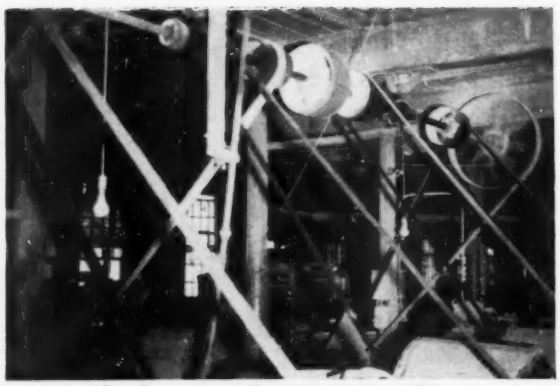
Running Pumps. Where you have operators on constant duty, make hourly and daily inspections of the pumps. Investigate immediately any change in a running pump's sound. Check bearing temperatures and stuffing boxes every hour. See that rings in ring-oiled bearings work right. Have just enough stuffing-box leakage to cool and lubricate packing. Too much leakage wastes fluid pumped. Too little may cause burned packing and scored sleeves.

If pump has pressure gages and a flowmeter, check every hour to see that pressure and flow correspond to plant operating conditions. Make a daily check of recording instruments to insure that output, pressure, or power consumption indicate right performance.

Be Careful. There are exceptions to the rule that a pump needn't be opened unless outside evidence shows it's necessary. On some jobs you may feel safer with clearance measurements and internal inspection. Just be sure to open pump at regular intervals. Otherwise, you won't have too much confidence in your maintenance.

Rules are made to be broken. A feeling of confidence in your pump is far more important than opening it a few more times than necessary.





Whether new or old, mechanical power-transmission equipment needs...

...Planned Maintenance for

Belts

Smart maintenance transmission-wise shows up as a twofold dollar savings. These savings come in reduced power bills, when transmission losses are cut, and in lower operating cost when belt replacements are fewer.

V-Belts. There are several possible trouble sources here that you should watch for in your maintenance program: (1) too few belts on a single drive (2) sheave diameters too small for belt cross-section (see POWER, Nov '52, p 112) (3) sheaves that have incorrect groove angle for specific belt (4) belts that run too fast . . . keep belt speed below 5000 fpm (5) belts of wrong construction used for a given application.

Tension is an important angle in V-belt maintenance. Ever play Crack-the-Whip as a kid? Chances are you ate supper off the mantle till you realized the tremendous snapping force a whipping action can produce. And if your V-belt hasn't enough tension, you'll get the same snapping action. This will happen more often at peak loads or when starting the motor. Any extra slack is suddenly taken up, and the last section of V-belt to be whipped taut is jerked with a force far greater than it was designed to stand. This is the reason why a loose V-belt in service will stretch more than a tight one.

So don't be afraid to pull V-belts tight. Stretching them slightly is good for their general health. Check often for stretch and sag, especially during the break-in period. *A slack V-belt feels dead when you thump it with your hand, a properly taut V-belt has an alive springiness.*

And while you're thinking about tension, check sheave alignment occasionally. A straightedge will do, or in a pinch, a cord. Just stretch it across the sheave faces and see that it touches all the four possible points of contact.

Leather Belts. Here are a few maintenance tips regarding leather belts. First, standardize on as few belt widths and plies as economically meet plant requirements. This cuts down variety of spare belting that must be carried in stock. Belt should not slip or creep more than 2% of total belt length. Frictional heat, created by too loose a belt, burns and cracks belt surface.

Where excessive tension is needed to prevent belt slippage, substitute a wood or fiber pulley for the small steel one. Belt tension can be reduced by lagging small pulley with leather, rubber or duck.

Excess crown on a flat pulley may produce strains along belt center line and cause premature failure. Have pulley face ½ to 2 in. wider than belt. Save transmitting power by checking that transmitting pulleys are in line.

Couplings

Proper alignment ranks well up on the flexible coupling maintenance list. Coupled shafts will transmit power at a higher efficiency where the shafts are perfectly in line. Flexible couplings are designed to compensate for unavoidable misalignment that creeps in after shafts are coupled. Bearing failures and shaft fatigue—because of alternate compression and tension of shaft's surface—result from excessive misalignment.

Another common trouble cause sprouts from selecting couplings too small for the application. This usually results from not giving proper attention to load characteristics and the power unit. Centrifugal pumps and fans under normal conditions represent a fairly steady load and cause little coupling wear. A plunger pump, on the other hand, represents a load that varies with the position of pistons and is continually subjecting couplings to shocks. Consequently, the coupling selected for the latter application must be large enough to meet the more severe conditions.

Where couplings are to be used for reversing service, give extra thought to the type selected. For instance, don't use couplings with considerable backlash for such an application. If reversals are frequent, select a coupling large enough to stand the service. Where couplings are for use with braking action, as on cranes and hoists, take account of these conditions and use a proper service factor. Correct service factors are generally listed in manufacturers' catalogs or technical bulletins.

Years back, men who operated machines were often skilled mechanics who lubricated and maintained their own units. They may not have been lubrication experts, but they did have a single-minded interest in keeping them going.

New Ways. As industry became larger and more specialized, maintenance tended to separate from operation. And, unfortunately, lubrication too often drifted off into an independent chore that got little real attention from anybody. "Oiling" became a low-skill low-pay job with little incentive. Today, lubrication engineers, relative newcomers to the professional field, are stepping into the picture. They're making lubrication an organized, plant function that will pay off in longer machine life.

Organizing. Best way to tackle the job of modernizing lubrication practice in your plant is to think of it as a separate function in the maintenance setup—not as an odd job to be done in spare time. Approach varies, depending on whether the lube group is being set up in a new plant or an existing one.

Start Early. In a new plant, the lubrication engineer in charge should work closely with designers, keeping them on the beam as to operation and maintenance. In this way most-effective lubrication equipment can be installed at the start and the whole system coordinated for best working results.

In an existing plant, you'll have to move step by step, but goal is the same—efficient, economical lubrication.

A Longer Life Span

By JIM SPARKS
Edmonton, Canada

Chains

You'll find power-transmission chain in practically all kinds of power jobs. Its great strength permits transmitting large power with small cross section. And it can run in temperatures that would quickly destroy belts. It is made in many forms, but let's call our shots here and concentrate on finished-steel-roller designs. You can adopt much of the info to other chain drives.

Drive Position. On short- or normal-center drives, the slack side of the chain may be either on top or bottom. Slack strand runs better on the bottom, because a loose top strand tends to disengage the drive sprocket teeth. On long centers, to prevent the strands rubbing together, have slack strand on bottom.

Avoid vertical drives where possible. But if you must use them, keep them fairly tight by frequent adjustment. You can reduce the care and adjustment needed if you install the drive slightly off vertical.

Alignment. Accurate alignment for any chain drive is an absolute must for trouble-free operation. Make the shafts, to which the drive connects, level and parallel, and the sprockets in line. You can check sprocket alignment with a string or straightedge held against their sides. As with belt pulleys, locate chain sprockets as nearly as possible to shaft bearings. To avoid excessive vibration mount motors and shafting rigidly.

Don't run roller chains with both strands tight. For best results have center distance between sprockets adjustable, to take up slack caused by wear. There is no definite rule for tension in a chain drive. In horizontal and inclined drives, normal practice allows a sag (when running) equal to about 2% of the center distance between sprockets. This is more than that used on belt drives. But it works well. On loads that fluctuate badly, run chain tighter to reduce flopping when chain is moving.

Bearings

Bearings fall into two classes; *sliding contact* and *rolling contact*. The former are also known as plain bearings, while the latter may be ball, roller or needle bearings. Operating engineers have spent many years with the sliding-contact-type bearing for power-plant auxiliaries, and are generally quite familiar with good maintenance procedures. So let's skip over to the rolling contact variety and review some proved field-maintenance procedures.

While you don't need to handle rolling-contact bearings like antique china, they do need proper care. They're precision made and this precision must be kept throughout their useful life.

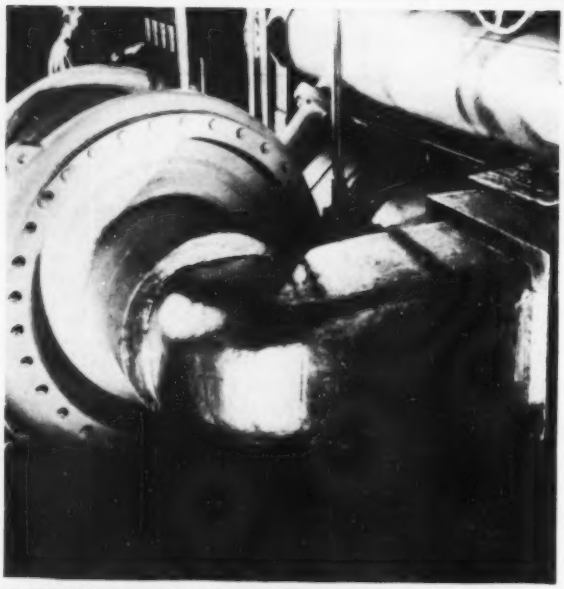
When inspecting an old bearing, look for excessive hardened areas. Streaks or spots are the giveaway. Check for cracked parts, etching resulting from contact with acid, discolored areas caused by overheating. Any of these should cause rejection. For a complete picture story on why ball bearings fail, see POWER, May 1951, p 116.

Bearing removal can best be done with a set of bearing pullers. They look and work like gear pullers. Apply pulling force on the inner ring that hugs the shaft. Don't tug on the outer race. Putting the bearings back on usually calls for a press and a pipe sleeve. After lining up the bearing, select a sleeve the diameter of the inner race. Put this sleeve between the inner race and the press. Apply even pressure and she'll slide home.

But installing some bearings may be tough work. It may call for heating the bearing in hot oil, and using special equipment to raise and lower it. Heating inner race to between 200 and 250 F gives a good shrink fit. Sometimes it's more convenient to use dry ice and shrink the shaft. This allows the bearing to slide easily onto the shaft.

We Slipped . . . a little

Some copies of the December issue were off the press when a typographical error on p 132 was spotted. In the second paragraph of the short article, "High-Temperature Greases Let Motor Run at 150 C," the equivalent of 150 C was listed as 202 F. It should have been 302 F.

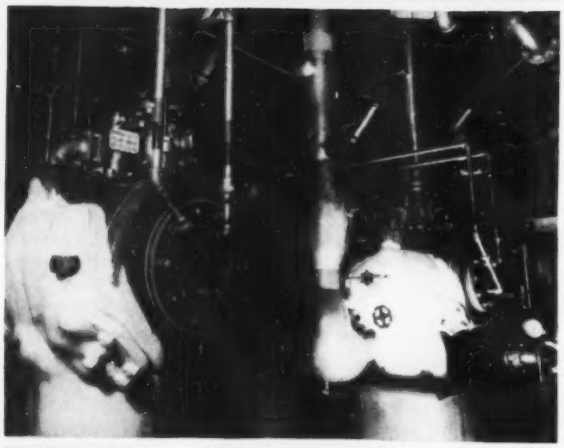


REFRIGERATION *M*AINTENANCE...

...Key to Better

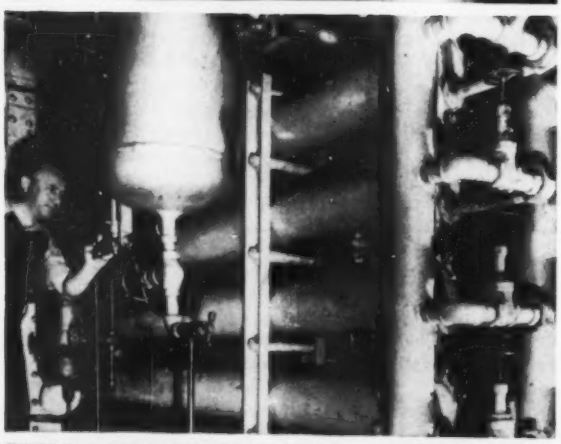
Centrifugal Compressors

Get manufacturer's help if you're new to centrifugals. They need care different from reciprocating units. Oil, grease, purge as recommended. Keep condenser and cooler tubes clean; repair leaks as soon as you find them. Check machine output regularly. Take complete log readings every hour, and use to keep you posted on exactly what machine does.



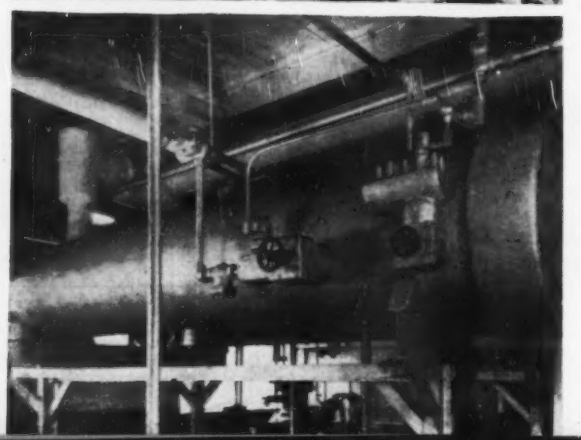
Reciprocating Compressors

Oil regularly, using good lubricant. Stop and check compressor as soon as you hear a knock, or capacity starts to fall. Don't let cylinders frost up too much; it wastes power. Take log readings regularly. Keep back and discharge pressure within ranges recommended for machine. Every watch, check valves, springs, packing, cooling-water flow, drive.



Condensers, Receivers, Separators

Clean condenser tubes as often as needed. Be sure your water supply is as cool and dependable as possible. See that purge valve is close to where air accumulates so you'll get best results. Purge when head pressure rises without change in load. Keep receiver clean, cool. If it has a gage glass, check refrigerant level often. Drain oil separator often.



Brine and Water Coolers

Keep tubes and shell clean, leak-free. Check brine strength once a day, raising or lowering concentration as needed. Have enough insulation on cooler shell and piping to prevent sweating. Repair damaged insulation immediately or you'll waste power. Check brine inlet and outlet temp every hour. Don't let too much frost collect on cold-room coils.

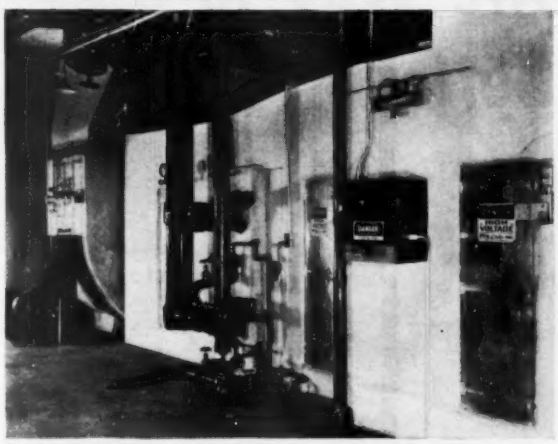
Cold-Job Output

Cooling Towers

Watch 'em, winter and summer. Look for broken or misplaced filling, plugged nozzles and algae. These can cause uneven water distribution. Be sure evaporative condensers are clean and leak-free. Watch for louver icing in winter; it may damage tower, cut output. Check often for piping, fan or tower vibration. See that condenser-water pumps are in good condition at all times. Play it safe; keep a spare pump ready so you won't lose refrigeration if one fails.

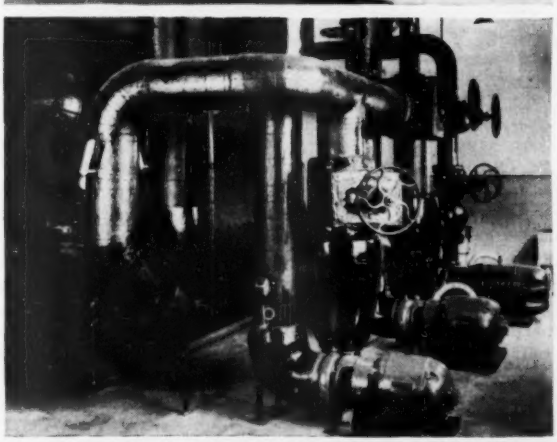
Air Washers

Clean and flush basin once a week. Keep interior and exterior painted at all times. This reduces corrosion, makes a neater looking plant. Have washer water analyzed and a treatment prescribed if washer corrodes or nozzles plug. Keep piping and other insulation in topnotch condition. Use safety signs wherever there's danger of personnel injury. Watch fan and its drive for trouble. Lubricate regularly.



Chilled- and Condenser-Water Pumps

If these don't run right, your compressor and chilled-water systems may go on the blink. Check pumps regularly to see that they are lubricated right, packing is OK, discharge pressure correct. Insulate piping to reduce heat gain to chilled water. Keep insulation tight; cover bare spots as soon as they appear. Check valves before starting pumps.



Ducts, Air Outlets

Be sure your ducts are clean, or you may get dirt and dust in conditioned areas. Use vacuum cleaner or other means to clean duct interior. Check air distribution from outlets to see that some areas aren't being "robbed." Readjust outlet if the air distribution isn't right. Check canvas connections to see they are tightly fastened to both ends of duct.

Checks and More Checks Are Way to Better . . .

CLOSE ATTENTION to details, from boiler-room stage, to piping gradient, expansion-tank vents, discharge velocities of air heaters, makes good heating system

1. STEAM HEATING

► THE DEAD OF WINTER seems a strange time to worry about heating. But it's the proof-of-the-pudding stage.

Water Treatment. Is your water clean? Right from the time you start up, the condition of your boiler water greatly affects system operation and performance. With a new system, open your safety pressure-relief valve and see if water comes out with the steam. If it does, you have a priming condition, and your system needs a thorough cleaning. In any event look into water-treatment methods. They can save you plenty. You'll find the right chemicals can con bat return-line corrosion.

Piping. Be certain steam and return mains are properly graded. For best results maintain a downward pitch from main steam header to the point where it joins the return main. Insulate all fittings. Have joints bonded. See that risers are right, anchors haven't slipped, expansion joints aren't binding.

Valves and Vents. Keep packing sound and tight around valve stems. Keep gaskets in flanges snug. Provide adequate-sized traps, and be sure they're clean. Strainers lighten maintenance in this respect. They're easy to flush and clean. See that your boiler-return trap vents air freely. This is most noticeable when heating up. If this vent passes water, check first that the return trap is set high enough above the boiler-water line. If it is, you've got a trap repair job on your hands.

Vacuum Pumps. Carry about 3 to 8 in. of vacuum on the pump gage unless you've got a high-vacuum subatmospheric system. Your pump ought to hold this vacuum by running only about half time. If not, or if you have no vacuum, look for faulty traps blowing into the returns or bad leaks in the return piping itself. Check the return water for high temperatures. If your pump vent blows steam, your traps are faulty. Sometimes you'll find a simple thing like a stuck vacuum switch causes your pump to run continuously.

Radiators. Many office buildings have gone to covers or enclosures over free-standing radiators on the theory they improve performance and appearance. Some enclosures will produce better heating effects, but poorly designed ones will do just the opposite. In general, see that air admission and exit to enclosure are ample and unobstructed.

Next, the better the chimney action within the enclosure, the better the performance. True convectors are supplied with proper enclosures for good service. But since they pull in air at the floor level, be sure heating surfaces are kept clean, air intakes and outlets unobstructed. See that your radiators are properly pitched. On one-pipe systems they must slope down to the valve, on 2-pipe systems the slope must be toward the return for best performance.

2. HOT WATER

Piping. Remember, air will always collect at high points in piping and radiators unless it's properly vented. Check for this often. See, too, that pipe grading stays as uniform as it was when the system first went into service.

If you've added to your original piping layout—for instance, have added a branch line at a different elevation or relaid mains originally graded downward—see that you've got an adequate air vent at the top of the new branch or main. The same precaution against air pockets ought to be checked when you reduce pipe size in horizontal lines. Each reduction should be an eccentric reducing fitting or coupling and the tops of all sections of the pipe joined should line up. While you're checking see if branches leaving the main header still have their tops all at a common level.

System Balancing. The expansion tank, where used, plays an important role in any hot-water heating system. Its job is to maintain enough pressure to keep the highest radiators filled when cold, and prevent the water boiling when hot. See that it is sound, has no leaks, that its overflow pipe is in good shape.

Gravity hot-water systems are largely self-compensating in overcoming heating troubles from wrong pipe sizes. You can't say the same for forced-circulation designs—usually plan to give a water temperature drop of about 20 degrees through the cycle. With much resistance in certain legs of the heating system the areas fed by these legs will never get a chance to heat up.

For good balance, so all parts get equal heating, install variable-orifice valves or adjustable fittings. Remember, with commercial pipes of uniform size in the different sections it is practically impossible to balance all circuits equally. You've got to go to these special fittings to get around the problem.

3. AIR HEATING

There are six basic rules of behavior for warm air: (1) Warm air rises vertically unless controlled. (2) Different-temperature air streams stratify. (3) Air moves horizontally with least energy. (4) Extra energy is needed to blow warm air down, cold air up. (5) Heat must be circulated to heat any zone efficiently. (6) Blasts of hot air destroy comfort heating.

These rules furnish an excellent guide to rating any hot-air system. Because unit heaters can meet all six of the guiding rules they've pretty largely taken over the field of hot-air heating in larger installations.

Piping. If you pull outside air through the heater, freezing may be a problem. Keep the pressure at the heater not less than 5 psi; in extremely cold climates, 10 psi.

Be sure all steam mains are dripped or drained at their ends into return piping system. Give long steam mains intermediate drips or drains.

It's good practice to install 3-valve bypasses around all traps draining the steam piping of large installations, or at least a shutoff valve on each side of the trap. This permits you to repair traps without having to shut down heat.

Sediment strainer ahead of every trap is another form of preventive maintenance. Strainer is easily, quickly cleaned, replaced.

Pitch all piping one inch in 20 ft except where steam and condensate flow in opposite directions; then pitch piping one inch in 5 ft.

Don't forget steam on the low-pressure side of a reducing valve contains superheat. It's almost equal to the difference in temperature between the steam in the high-pressure side of the reducing valve and the temperature of the boiling point of the water at the pressure on the low side of the reducing valve. This superheat frequently interferes with the heat-emission of unit heaters. If you find this is happening, install a desuperheater.

If you've got erosion and water hammer in the returns of a high-pressure system, your piping is too small. Vacuum pumps don't prove too practical in this class of heating system. Your only solution to the problem is to replace the return-line piping.

Traps. Use either combination float and thermostatic traps or inverted bucket traps with a thermostatic-trap air bypass. Capacity should be not less than twice the rated condensing capacity of the heater. Each heater should be separately trapped. Check all traps frequently. See that they're working properly.

Controls. Unit heaters put out about 10% of their rated capacity when the blower and motor are shut down. A simple room thermostat will regulate the periods of On and Off quite satisfactorily.

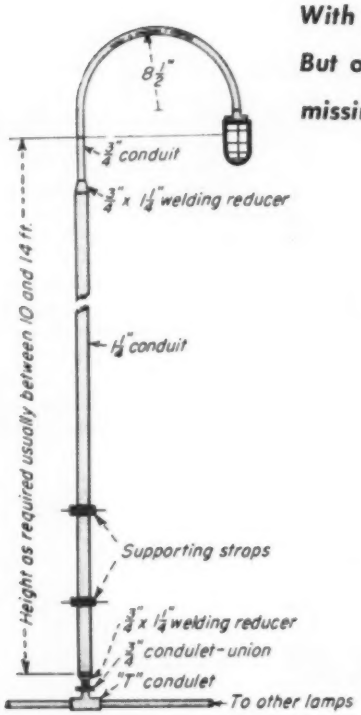
Recommended control is combination of room thermostat and surface aquastat or pressurestat. But never install the thermostat in a dead-air pocket or in the air flow from a unit heater. You can, however, put it in the air-flow stream to the heater.

To prevent unit heater from circulating cold air during the winter months when your steam pressure is down, install a reverse-acting surface aquastat in the return connection from the unit heater and connect it to the electric wiring to the heater motor.

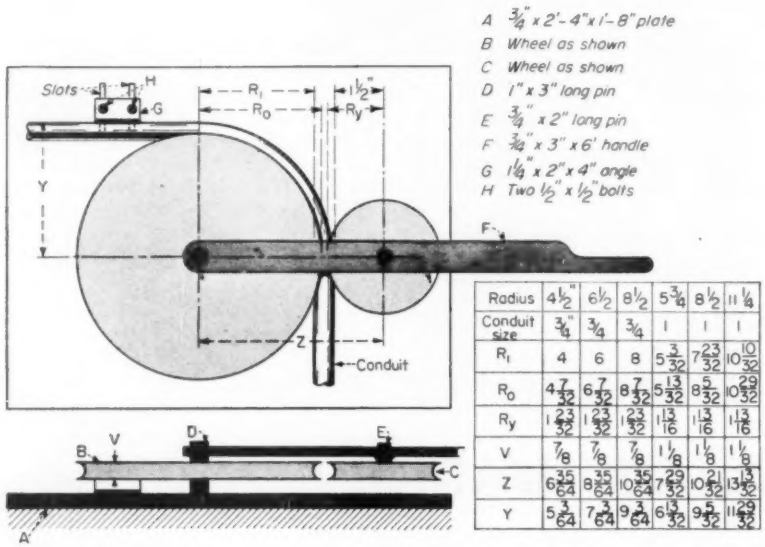
Air Filters. Filter area should never be less than twice the face area of the heater with a propeller-type unit. Clean or replace filters often to prevent starving unit heater of air and causing motor trouble from undue loading.

Coming Through in a Pinch

With plenty of time, tools and materials, we can all do a good job. But often we must do the job with some of these basic ingredients missing, as pointed out by Sergio Martinez Jr, down in Oriente, Cuba



CONDUIT BENT for this outdoor lighting unit by the shop-made rig shown to right



Radius	4½"	6½	8½	5 3/4	8½	11¼
Conduit size	¾"	¾	¾	1	1	1
R_1	4	6	8	5 3/32	7 23/32	10 10/32
R_o	4 7/32	6 7/32	8 7/32	5 13/32	8 5/32	10 29/32
R_y	1 23/32	1 23/32	1 23/32	1 13/16	1 13/16	1 13/16
V	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8
Z	6 35/64	8 35/64	10 35/64	7 29/32	10 21/32	13 13/32
Y	5 3/64	7 3/64	9 3/64	6 13/32	9 5/32	11 29/32

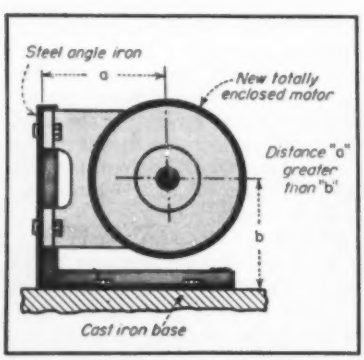
CONDUIT BENDER in its final position after bending a full 90-deg elbow. It does good job but doesn't compare with the modern high-power portable hydraulic benders

1-Simple Plant-Made Bender Speeds Conduit Installations

In running conduit for outdoor lighting, or in wet locations, weatherproof fittings must be used throughout. Typical would be the simple and neat-appearing lamp post shown above.

Post consists mainly of a section of 1¼-in. electrical conduit with two 1¼x¾-in. welding reducers at each end. Bottom of post connects to a regular weatherproof conduit fitting. Top end of the 1¼-in. conduit connects to a section of ¾-in. conduit, bent through a full 180 deg as shown. Far end of the bend screws into a weatherproof unit.

In making this rig, or in fact for any conduit-bending job around the plant, the homemade bender shown above works fine. By following the information and sketch given you can make the bender in your plant shop. Note that by changing wheels, bends of different radius can be made. Although the information listed is just for ¾ and 1 in., larger conduit fits similar rig.



2-Vertical Mounting Lines Up Oversize Motor With Old Pump

We have a pump that is mounted on a common cast-iron base with a standard open-type motor. To be precise, we had this setup until recently when we changed the open for a totally enclosed.

The first time we knew of the new motor was when we got an order to install it on a Sunday and have it running that evening. If everything had fitted, it would have been a simple job. But the new motor was one frame size larger. And that meant the distance from the base to shaft center was greater in the new motor. Offhand, the answer seemed to be to disconnect the pump and raise it on the base with spacers. But that would have meant reworking the pump input and discharge piping.

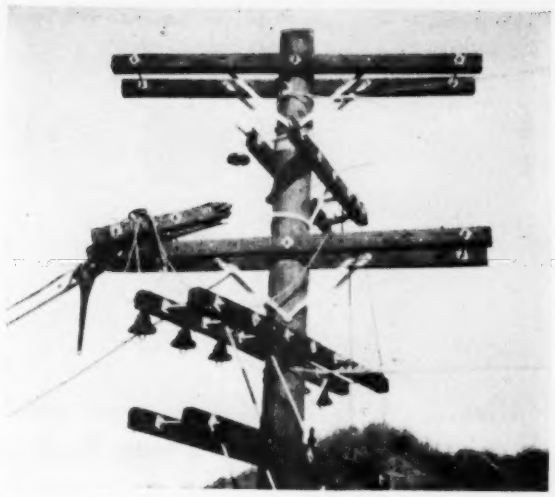
Best solution we could think of was the one shown in sketch. With angle irons, we built a new vertical base fastened to the original horizontal base. Since the motor had ball bearings, changing position was no problem.

3-Angle Iron Serves Well As Crossarm Reinforcing

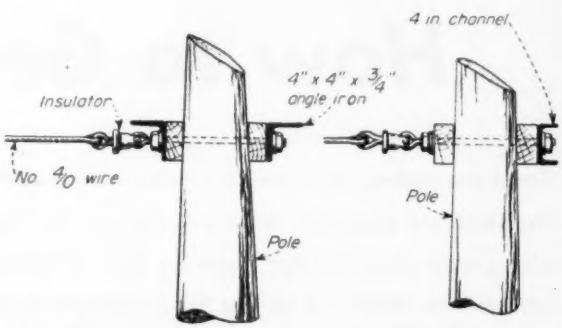
During a recent installation of power lines between scattered buildings in our plant, we ran into a problem with a number of 4/0 lines that ended in strain insulators. Each insulator was fastened on double 4-in. crossarms. First time we tried stringing one of these lines the wood crossarms broke, as shown in the photo.

Inspection of the broken crossarms showed they had failed along the holes drilled in them for the pin insulators. Since all crossarms on hand were drilled alike we went ahead and reinforced them with 4x4x$\frac{3}{8}$-in. angles and 4-in. channels. We used either channel or angle depending on what was available. Results are shown in sketches to right.

After reinforcing we were able to string all our 4/0 lines with just the right sag, and we met no further trouble. Incidentally both channel and angle iron can be used to good advantage to support small distribution transformers. These are often set on poles to feed isolated loads at low voltage. Typical would involve transforming 2300 v to 120/240 v to feed a small lighting and power load in some remote spot.



CROSSARM SNAPPED along holes drilled to take pin insulators. Feeder lines were No. 4/0, deadening on crossarm insulators



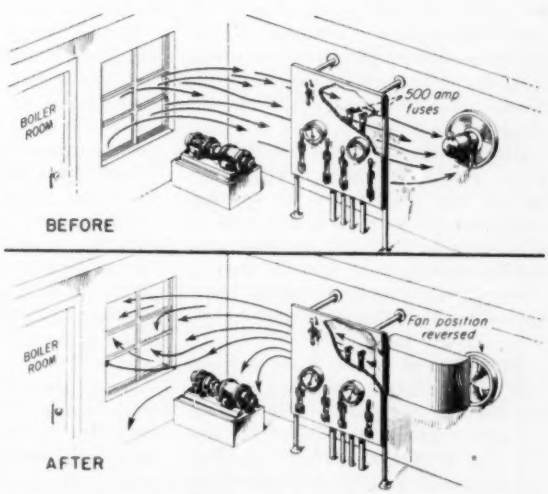
ANGLE AND CHANNEL iron, lined up along outer sides of wood crossarms, gave the needed reinforcing to hold heavy lines

Keeping Fuses Cool

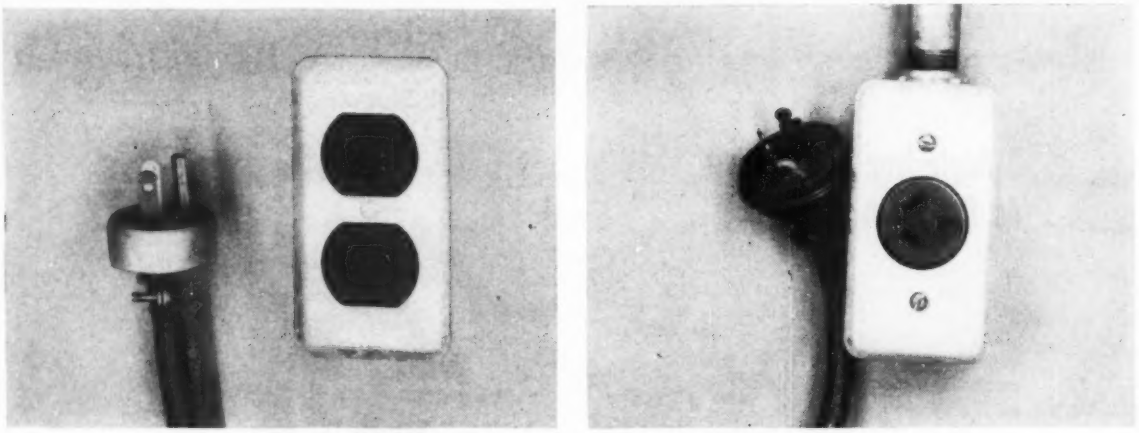
When 500-amp fuses blow at 350 amp, suspect overheating as the cause. Trick is to track down the source of heat. In our case the heat did not stem from poor connections or high resistance in the fuse. We checked for all these.

But we did notice the trouble occurred during hot weather. We have a hot engine room; 130 F and above at the ceiling. Switchboard was set about 10 ft from boiler-room wall. A strong blast of hot air starting in the boiler room would find its way behind the switchboard. And since the fuses were only 18 in. from the ceiling, the heat buildup was enough to lower the fuses' blowing point. This air flow was caused by exhaust fan in switch room.

In solving the problem we made up a short section of duct so its opening half covered fan exhaust. Then we reversed fan position so it blew in rather then exhausted. Now the relatively cool outside air is drawn in and blown behind the switchboard. *James W Blake, New York, N. Y.*



FREQUENT BLOWING of 500-amp fuses when carrying only 350 amp, was cured by pulling in cool air and directing it over fuses



These 3-Prong Plugs Assure Equipment Grounding

Newer grounding receptacle, left, permits use of regular 2-prong plug or mating grounding cap. This means conventionally plugged equipment is not ruled out if this receptacle is used. Grounding plug-receptacle to right lacks this flexibility feature

How to Ground Portable

Good grounding of portable equipment is a safety must in the maintenance program. Here are four of the approved methods along with practical tips showing how each is best used. Recommended minimum values for resistance to ground are listed

By **H B WHITAKER**, *Sr Associate Electrical Engineer*
Underwriters Laboratories Inc

► THERE ARE three practical means of grounding portable equipment: (1) approved grounding plug with one prong tying frame of portable tool to circuit conduit (2) grounding conductor run along with the circuit wires and connecting to an approved multi-prong plug; grounding prong ties between ground wire and frame of portable equipment (3) separate flexible wire or strap may be insulated or bare, connecting directly to a suitable ground. When properly applied, any of these methods will prevent equipment frames becoming live to ground.

Grounding at Outlet. When you boil it down, the biggest problem in grounding portable equipment is completing the grounding circuit *at the supply outlet*. The present widely used parallel-slot receptacles and parallel-blade plugs are 2-pole devices. These devices don't lend themselves to automatic grounding when the attachment plugs are inserted.

Many attempts have been made to lick this problem through use of adapters and pigtail connections on the grounding wire. But human element always has to be depended on to establish the grounding circuit.

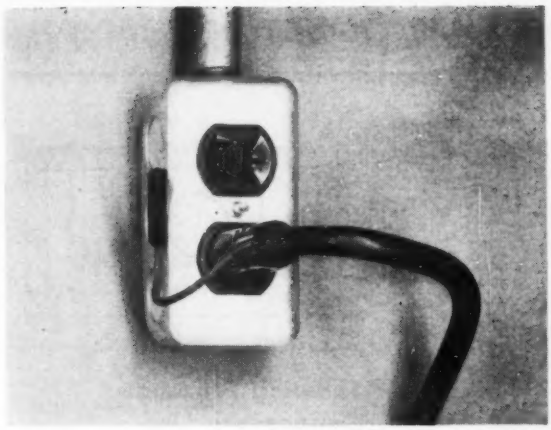
Multi-Prong Plugs. A major step forward was recently made when the grounding multi-prong plug and receptacle, above left, was developed. This receptacle handles existing 2-pole parallel-blade-type plugs, or 3-pole attachment plugs having a round or half-round grounding blade. Since receptacle will take existing-parallel blade plugs, it does not present a problem on equipment with 2-pole plugs. There are additional advantages to using this newer-type receptacle plug; grounding is automatically handled, plus the fact that the inherent design rules out use of the 3-prong-type plugs where all poles may be alive (as is met within 3-phase portable tools).

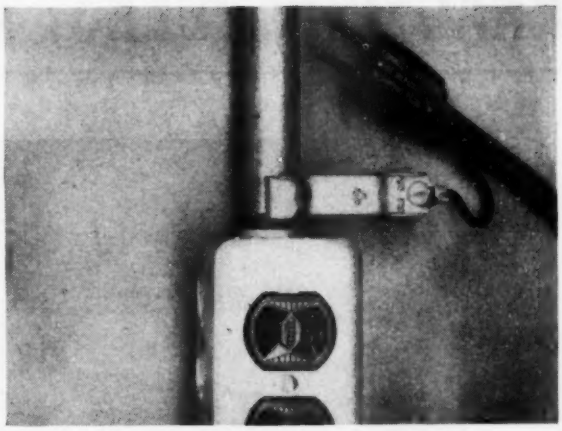
Be cautious with 3-prong receptacles and plugs that may be used to feed 3-phase loads and 3-wire Edison systems as well as 2-wire systems with equipment grounding. This variety of possible uses means we can occasionally expect accidents when portable tools intended to have a grounded frame are plugged into a 3-phase receptacle.

When a manufacturer supplies a multi-pole attachment plug on portable equipment, it is no guarantee that the user will supply a suitable receptacle. Often the user replaces the multi-prong with a 2-pole plug. And in so doing he may get the ground conductor mixed up, leaving the tool frame alive rather than grounded.

Pigtail Connections. Various arrangements of the pigtail idea are recognized as suitable grounding methods. One is the plug-and-jack type of connector, facing page. Here the ground wire, separate from the power plug, slides on a grounding terminal permanently attached to the receptacle.

Another method uses a battery clip. This is one solution where portable equipment will be used at various outlets around the plant, assuming that a conduit or water-pipe connection is always handy. Spade-type lugs with upturned ends are often selected as grounding terminals. Here you can ground at any point on metal raceway





Flexible Pigtail Connections Are OK If Properly Made

Equipment grounding lead is brought out just above the plug. Sleeved ground wire, left, slides over male pin that screws into receptacle center. Battery clip, right, makes good ground connection to circuit conduit. Attach ground before plugging

Electrical Equipment

where such a lug can be slipped under a machine screw.

Multi-prong plug has the basic advantage over pigtail connections in that grounding is automatic each time the attachment plug is inserted. On the other hand, there is one major disadvantage with many of the older multi-prong plugs and receptacles; they immediately rule out existing 2-pole plugs on present equipment.

Another weakness in the pigtail picture is that the proper sequence of making connections is left entirely in the operator's hands. The ground connection should be made *before the tool is energized.*

Wire Size. Where grounding wire is part of a flexible cord assembly, make grounding connection in the tool with a machine screw. This simplifies reconnecting the ground wire if and when the supply cord is replaced. Grounding connection bonds all exposed non-current carrying parts of the tool.

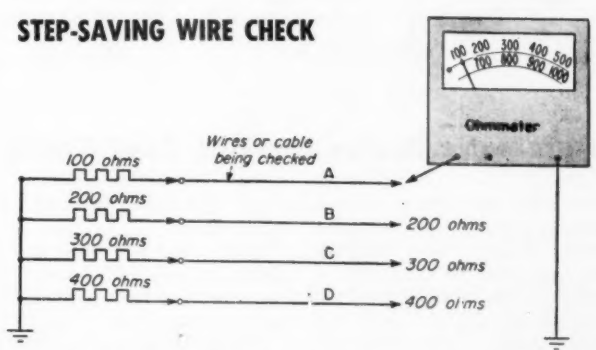
Ground wire for portable equipment may be No. 18 or 16 Awg when fuses or circuit breakers are set within 20 amps. Use a No. 14 wire where the overcurrent device is set between 20 and 30 amperes.

Grounding to Earth. Your grounding circuit must have a low resistance to insure that enough current will flow on an accidental ground to trip the overcurrent device. Low resistance also means that with current flowing in the grounding circuit, connected equipment is never at an appreciable above-ground potential.

Here are some safe rules to follow: For a 120-v circuit, protected by a 30-amp fuse or breaker, the grounding resistance should be less than 3.6 ohms. It's a good rule to keep the resistance of water-pipe grounds at about 0.25 ohms. Resistance of the connection to earth, at the plant grounding source, is often the biggest resistance in the complete grounding circuit.

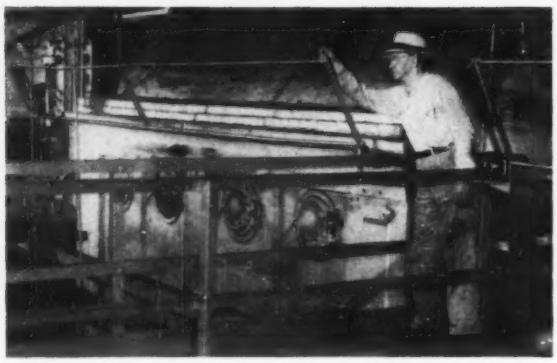
Where driven grounds are used the resistance to ground should not be greater than 25 ohms. Actually if you look into it, this resistance is not low enough to blow a 30-amp fuse on a 120-v circuit. But it does give a measure of protection against accidental crosses between primary and secondary of a distribution transformer.

STEP-SAVING WIRE CHECK



Save time when "ringing out" wiring in cable or conduit by first hanging separate resistors of different ohmage across leads at far end. Tag wires No. 1, 2, 3, etc, corresponding to size resistor used. Your ohmmeter will pick them out at this end. *L W Fitzpatrick, Jefferson City, Mo*

PRACTICAL IDEAS...*here's the trading post for your*



Safe Way to Blow Water Column

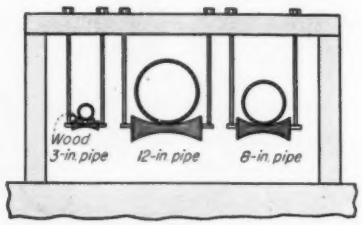
BOILER-WATER COLUMN should be blown down at least every shift. It's the only sure way to know level shown is correct.

Fire-room foreman in photo is blowing column from upper platform. Upper and lower cocks on gage glass have long reach rods to catwalk. By turning valve lever on end of rod, reach rod revolves, actuating valve.

To blow a column correctly, close top cock and open drain valve on blowdown line. Then all water blows through bottom cock. Close bottom cock, open top, so only top cock blows. Now make sure both cocks are open. Close drain valve on blowdown line.

This is only sure way to clear both gage-glass connections. Many tubes have failed because a column connection was plugged—given false reading in glass.

BILL DAVIS
National Safety Council, Chicago, Ill.



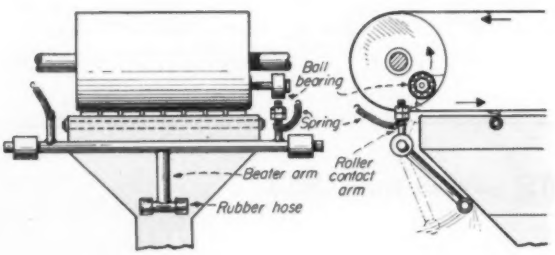
Thawing Frozen Condensate Line

WHEN 1200 FEET of 3-in. diameter condensate line from our mill froze, we hooked on 400-amp capacity welding machine. After two days, not even a hundred feet thawed.

We called on local power company to give a hand. They had a 37.5-kva single-phase transformer and some 0000 cable they hooked to 4900-v supply. Secondary of 20-1 ratio transformer was hooked on to 3-in. pipe and we went to work.

We didn't get far until one of our men noticed an arc running down support rods on pipe hangers, sketch. That showed current was flowing through 3-in., 8-in. and 12-in. pipes—greatly reducing heating effect. After placing wood blocks under 3-in. pipe all along hangers, as shown, entire pipe thawed in only three hours this time.

G E BOYHAN *Ticonderoga, N. Y.*



Automatic Beater Unplugs Coal Chute

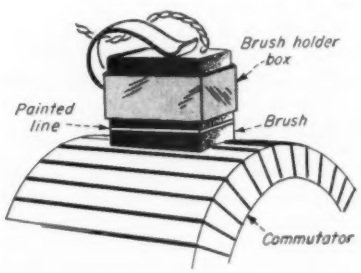
WE HAD TROUBLE with chutes beneath belt scrapers on our coal conveyor belts. They became plugged when handling wet coal. Fine wet coal removed by scrapers built up in chute, didn't flow.

To eliminate trouble, we built the chute beater shown. Cross shaft and beater arm are made of ¾-in. double strength pipe. Roller contact arm is a 2-piece arm of short pieces of ¾-in. pipe welded to the cross shaft. A ⅝-in. nickle chrome nut's welded onto upper end. By using a short length of ⅝-in. rod threaded to fit this nut, contact arm can be adjusted to vary length of beater arm's stroke.

Beater head is a piece of 1-in. pipe about 3 in. long, with 2 pieces of rubber hose over ends that prevents metal-to-metal contact from wearing chute.

Tripping roller is a 3-in. ball bearing, mounted on a supporting bracket. Bracket in turn is welded to inside of conveyor-belt pulley. Bearings for cross shaft are small lengths of 1-in. pipe, supported by arms welded to conveyor frame. This beater works like a charm.

O HOKSCH *Lansing, Iowa*



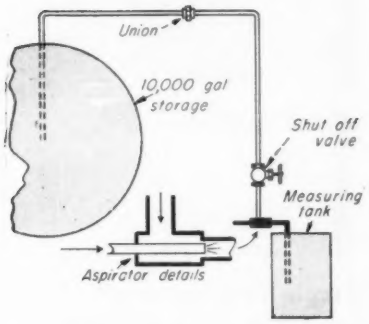
Brush Marking

MARK A THIN LINE with white or yellow paint across face of motor and generator brushes used in box-type brush holders, as shown. Place line on brush so bottom of holder box will coincide with line when brushes reach the end of their wearing distance. Then time for brush replacement is automatically indicated. When the colored line appears below the edge of brush-holder box, replace the brush with new.

T TRAIL *Catonsville, Md.*

operating and maintenance short cuts

STEVE ELONKA, *Associate Editor*



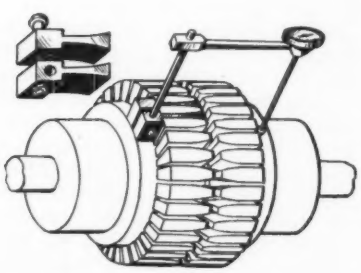
Handling Acid Safely

WE HAVE SULFURIC ACID stored outside in a 10,000-gal tank. Acid was piped from bottom of tank to measuring tank inside building. Method of handling created various hazards. To overcome, we installed a siphon, sketch.

To start siphon, we made aspirator out of pipe, sketch. But acid was so heavy that we bought a more efficient aspirator. This one works on compressed air. By using this setup, a break in line above acid level in 10,000-gal tank will break only the siphon.

It's so piped that acid leak below level will run into measuring tank. When the line plugs, we open union, and either rod out the lines or take them down to clean, or replace. No worry about acid flying over someone.

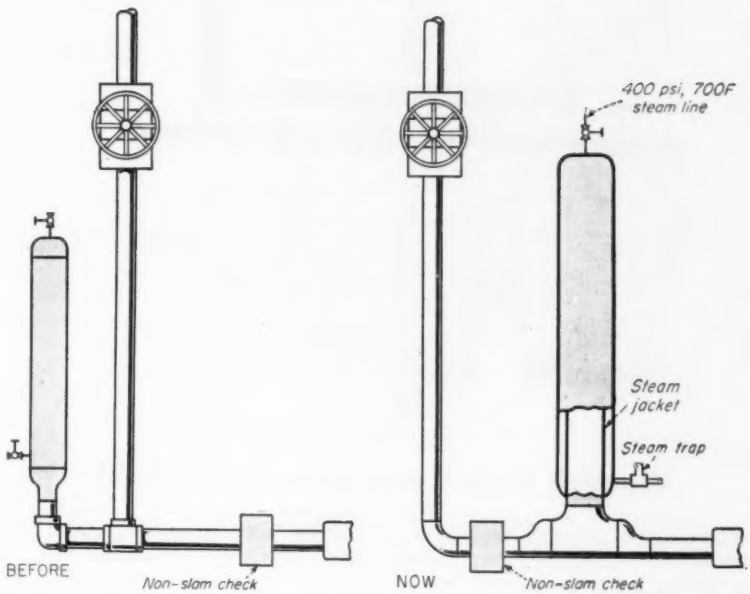
K M WHITE *Clinton, Iowa*



Lining Up Grid Spring-Coupling

SKETCH SHOWS method I use for getting indicator reading on grid spring-couplings. This method is reliable, also very simple and compact where couplings are close-connected. There's little chance of getting a false reading as with makeshift devices. Easy attachment for a quick check on shutdown is best feature. Clamp is easy to make.

E R BRIGGS *Dunedin, Fla.*



Steam Cushions Better Than Air Chamber

TROUBLE DEVELOPED in a steam-pressure-reducing and desuperheating station. Pressure was 400 psi, at 700 F, which was to be reduced to 150 psi saturated.

A variable-displacement pump driven by an electric motor furnished water for cooling spray, but water hammer set up in this pump. Hammer was so severe that we used boiler feed-pump instead. This set off a series of troubles. I'll only mention a few.

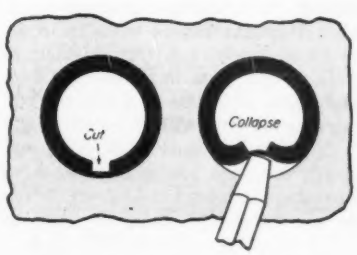
Water hammer was severe and destructive. Oil lines on pump broke off at fittings. Air control lines for desuperheating station also failed. Piping throughout plant vibrated, and controls were erratic. No one would risk operating pump for more than 10 or 15 min.

Pump had been installed with a non-slam check on discharge. Later a T had been installed with an air chamber, drain and valve on top of chamber to admit air when the chamber was drained, sketch.

It was easy to check that little air space remained in chamber when pump operated at 500 psi. So remaining air was quickly absorbed. This was checked by installing a gage glass. It was my belief that if air chamber was large enough, water hammer would stop. We installed new chamber. It is not filled with air, but with steam, which is formed by evaporating the water with a steam jacket around chamber. Jacket is filled with steam at 400 psi, 700 F.

Theory proved correct as there's no further trouble with water hammer.

E H ROPER *Toledo, Ohio*



Cutting Out Boiler Tubes

FIRST, CUT TUBE to be taken out, as shown. Then knock up towards center, which usually makes tube easy to withdraw.

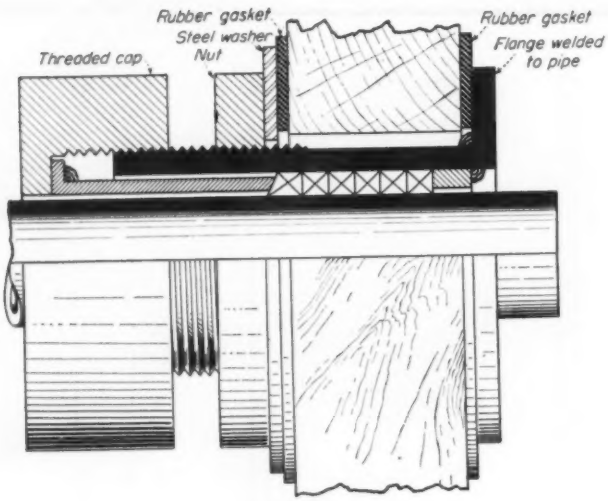
Take care not to cut all the way through tube or you might harm the tube sheet. Collapse tube all around.

T H CARR *Shipley, Eng.*

(*Continued on page* 126)

More PRACTICAL IDEAS

Begins on page 124



Wooden Tank Connection Stays Tight

HERE'S A WAY to install water lines to wooden water tanks. Feature of method is stuffing box with threaded cap for holding gland in place without weakening wood. Stuffing box is made in shop of improvised material, sketch.

In general, use three pipe sizes to give proper spacing (1/32 to 1/16 in.) between water line OD and gland ID, and between gland OD and threaded tube ID. Use tubing for intermediate pipe, also for gland.

For instance, for a ¾-in. standard-pipe water line, use a 1¼-in. tubing for intermediate pipe, or gland, and a 1¼-in. standard pipe for threaded tube.

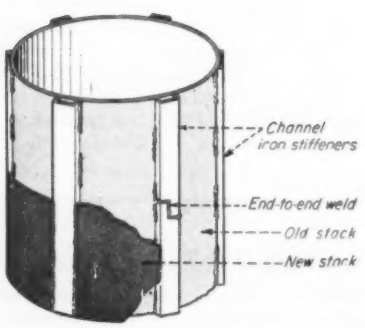
For a 1½-in. standard-pipe water line, use 2-in. standard pipe for gland, and a 2½-in. pipe for threaded tube.

Use at least four packing rings and make threaded cap long enough to take up on rings. When in place, threaded nut should engage threaded tube for equivalent of two packing rings.

Make threaded cap and threaded nut hexagon or square, so a wrench can be used to tighten them.

J H QUAY *El Paso, Tex.*

Old Steel Stack Gets New Lease on Life



OUR NO. 2 STEEL STACK was corroded and in danger of buckling at bottom. Stack was good for further life if we could stiffen lower section.

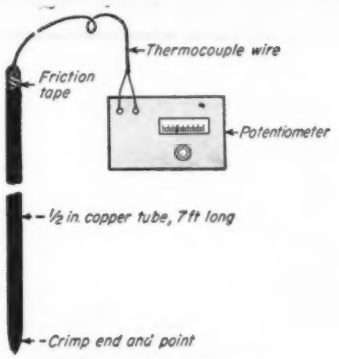
We welded 8-in. channels vertically, 60 degrees apart around stack, sketch. These were carried beyond danger zone.

Channels were placed against stack with flanges inward, flanges stagger-welded to stack metal. Each six to eight inches was welded, while next six to eight inches was left unwelded, with unwelded portion of one flange welded on the other. Channels were also welded end to end as shown.

A few years later this stack had to be rebuilt. We extended channels up to top. Then cut formed plate to fit between channels, and rebuilt stack by welding new plate to channels at base of flanges. This gave us a new stack at a reasonable cost, without boiler outage.

Old internal stack, left in place, should lengthen life of new stack as corrosion continues to take place, mostly on old metal. At least, we hope so.

J A SWANSON *Ocean Falls, B. C.*



Simple Thermocouple For Coal Temperature

WHEN OUR PLANT RECEIVED its first boat load of coal, the boss worried about spontaneous combustion. Coal was inferior grade, low in Btu (average 10,000 Btu per lb) and high in ash and sulfur. We had no way to pack mechanically.

In attempt to prevent combustion, we rammed several 40-ft lengths of ¾-in. pipe horizontally, six feet up from pile's base. Then we inserted thermocouple wire and took readings weekly. For many weeks no temperature change was noted. We abandoned this method and took temperatures in flanks and at peaks. That showed changes.

To do this, we took a 7-ft ½-in. copper tubing, crimped one end to a point. Into this tubing we inserted a length of thermocouple wire, properly twisted and fused at tip. We taped on wire at open end of tubing and around it. That was to prevent cutting and to help hold wire in tubing. Several feet of wire connect tube to a potentiometer.

Once a week we traversed flanks and peaks, poked copper prod five or six feet into coal. Then we noted progress of rising temperatures on a schematic plot of pile. We had to move and use various areas of pile to prevent combustion. Our rules were simple: 120 to 135 F—watch this area for further rise; 135 to 160 F—move and use this area.

Handled properly, the prod will last a season under weekly use; small kinks may be easily corrected as they develop.

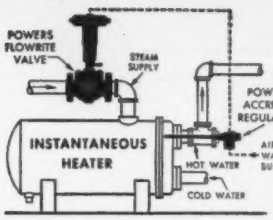
F M SOUTHWORTH *Essexville, Mich.*

Uses for Old Cable

DISCARDED ELEVATOR CABLES can be used for small choker and sling loads. For plant parking lots, discarded boiler tubes with welded elevator cables form good auto barriers and fences around parking area.

L FITZPATRICK *Jefferson City, Mo.*

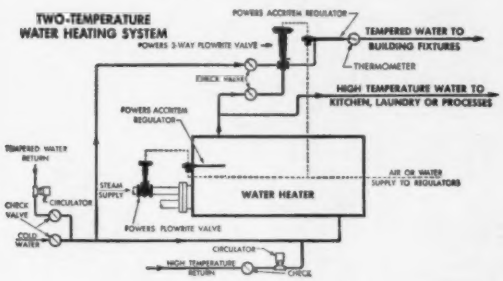
(*Continued on page* 128)

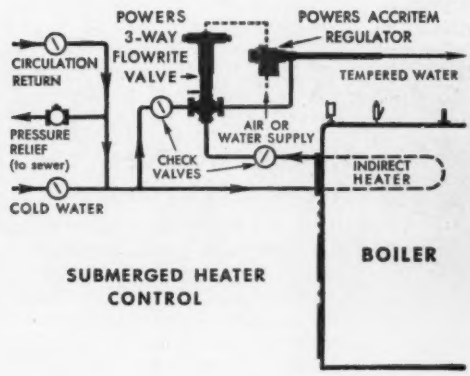


POWERS

ACCRITEM REGULATOR

Only a few of many uses





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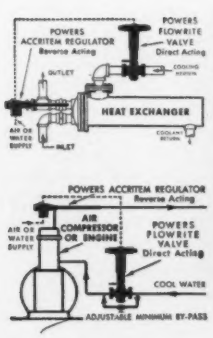

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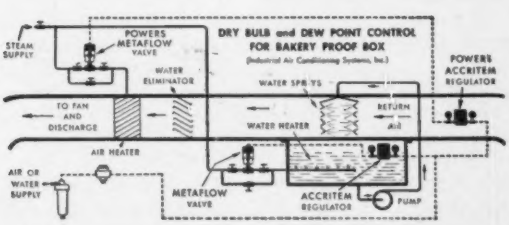

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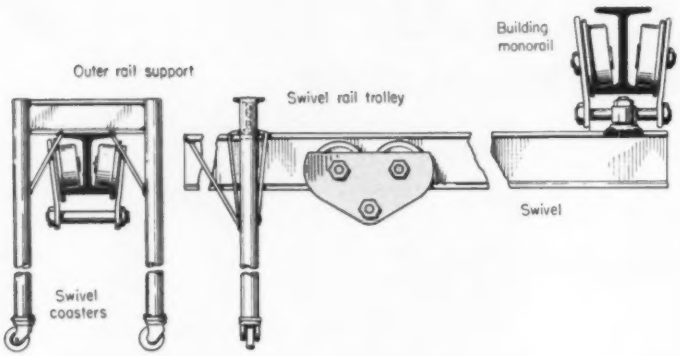
Over 60 Years of Temperature and Humidity Control

More PRACTICAL IDEAS

Begins on page 124

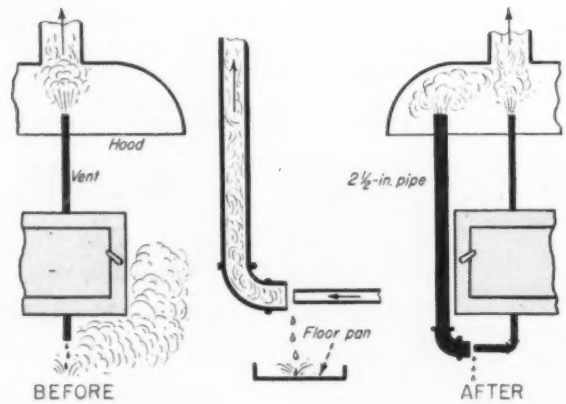


Overhead Crane Swings Around Floor

THE PERMANENTLY FIXED building-monorail, swinging-rail shown can be moved full length of building. As it's mounted on a trolley and swivel and supported near outer end, rail can swing in a complete circle at any radius point on monorail. Because hoist is carried on a trolley, it can make any radius needed.

Swinging rail is a 6-in. I-beam and long enough to reach any outer point on building floor. Outer support is made from 2-in. double-strength pipe and mounted on rubber-rim wheels that can swivel. All dimensions can be made to suit need of almost any plant.

H J GREINER *Anoka, Minn.*



Venting Vegetable Cooker Exhausts Steam

BOTTOM DRAIN removes condensate from a hotel kitchen vegetable cooker by direct contact with low-pressure steam. A top vent, running up to overhead hood, connects with exhaust system preventing pressure in cooker from rising much above atmospheric pressure. That caused trouble.

Steam blew out the drain with condensate, making it tough on kitchen help. Throttling incoming steam to stop blowing was given up. That prolonged cooking time too much. We first tried a steam trap, then a U-trap with water seal on drain, finally throttled the drain. But none worked as the drain quickly became stopped with vegetable particles.

Sketches show how we solved problem. The 1-in. drain runs up to open end of 2-in. pipe, but is not connected. Momentum of steam blowing from one line carries it through larger pipe to hood. Vapors are exhausted through hood while condensate and vegetable particles drop through opening to floor pan solving our problem completely.

A HOLT *Atlantic City, N. J.*

How to Place Parts Accurately by Crane

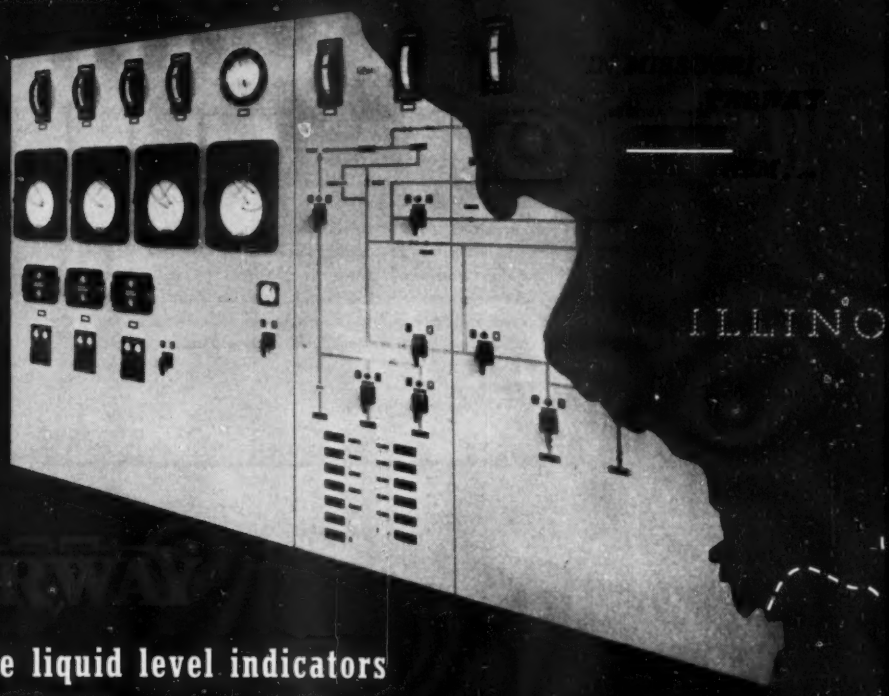
PARTS TOO HEAVY to handle by hand often have to be accurately placed by crane. I mean machine parts with tap bolts that hold them in position have to enter in tapped holes while one part is hanging on crane hook. If crane has a micrometer control on its hoist, there's little trouble. But if you work with ordinary hoisting engine, or if electric traveling crane is equipped with a hoist that has too high speed for close adjustment vertically, you're in for trouble.

If operator misses proper setting by stopping too low, a signal to raise piece always results in raising too high.

I once erected large-sized hydroelectric generators. Units had rotors split in halves, with stators in quarters to permit railroads to handle. When rotor was ready to have its 1200-lb field poles bolted on, we had trouble. When next unit was ready for same operation, we had a bright idea. We hung a one-ton set of chain falls on the crane hook, then hooked each pole in turn on chain fall's hook. When crane operator had placed pole within easy range of right location, we juggled pole up or down with chain fall, as needed, so helpers inside rotor rim could easily start tap bolts. Bolts were threaded into holes in pole pieces. This method was so effective we did no hard work. We did second job in one fourth the time. Only change was using a one-ton chain fall, sketch. I've used this idea often.

H B MCDERMID *Norwood, Ohio*

The Empire District Electric Company orders and reorders...



remote liquid level indicators

YARWAY SERVICE GOES ALL THE WAY...

PLANT PROBLEMS... *put your know-how to work*

How Does Water Get Into Fan Bearings?

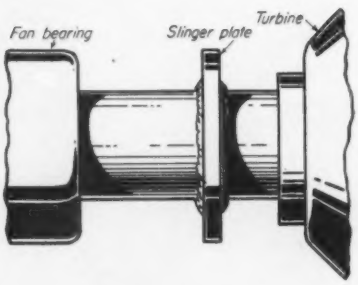
HERE ARE THE FACTS: One boiler in our plant has a 34-in.-dia turbine-driven f-d fan. It's a propeller type, driven by a single-stage turbine using oil-free exhaust steam.

Turbine seals on the shaft are mechanical type. Fan has two bearings, with oil supplied from a reservoir by a gear pump at shaft end.

Recently we've been getting water in oil reservoir. The first time we kept turbine running without changing the oil. Both bearings burned out and had to be replaced.

Now we drain oil from reservoir every week. If we don't, bearings fail after about two months. How does water get into these bearings? What can we do to stop it?—*KC, October Power*

Here Are the Answers



CHECK OIL COOLER for tube or element leaks. In our plant we try to keep oil pressure a few pounds higher than water pressure. Then if there's leak, water cannot enter oil side of cooler.

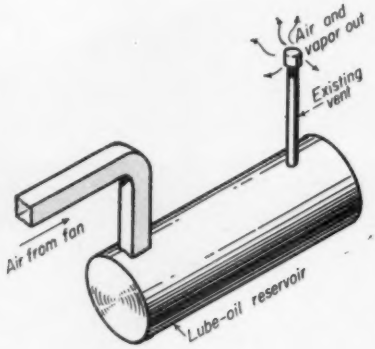
If cooler is OK, check mechanical seals on turbine. Steam leaking past seals may strike bearing housing and heat it. Air temperature in housing rises, and the relatively cool oil passing through bearing condenses water vapor in air. Water formed falls into the oil and settles in bearing, or is carried back to lube-oil reservoir.

To stop steam from striking bearing, weld a slinger ring to shaft as shown in sketch. This stops any steam and water that may start to flow along the shaft from the turbine seal.

H E Alekna *Brownsville, Tex.*

TILT OIL TANK or make a slanting bottom for it so water will accumulate at a low point. Drain sludge and water each shift. Check reservoir while fan is running and while it is stopped. You may find condensation cause this way. If necessary, change reservoir location in the plant turbine room.

Don Cochrane *Milaca, Minn.*



CONDENSATION in lube-oil reservoir is most likely source of water if turbine seals are tight. Ventilate reservoir by running a small duct from fan to top of tank, as in sketch. This setup is good only when fan runs all the time. If main fan is shut down from time to time, use a small electric fan to circulate air because worst condensation occurs while fan is stopped.

You can use another trick to get rid of the water. Fit a small trap tank to bottom of main reservoir. Water will settle in small tank, from which it is easily drained. If water and oil emulsify, see your oil company.

P D Hobson *Ottawa, Canada*

MECHANICAL SEALS sometimes leak more on starting and stopping. Check for this condition if fan runs less than 24 hr per day. Also check to see if turbine throttle leaks while fan is shut down during the day or night.

C G Howarter *Canton, Ill.*

BE SURE oil-tank cover is tight and hasn't any holes. Water or vapor-laden air may enter tank through these openings. Use a tight cover with a gasket, and don't forget to install a breather line venting to a dry location or to outside of building.

Check for air entering around oil feed line to bearing, through horizontal joint in bearing halves or from a draft passing over bearing. Use slinger plate on shaft to deflect drafts and moisture that may pass along it.

Sergio Martinez *New York, N. Y.*

IN OUR PLANT we had the same trouble. Tracing out the oil line we found it ran parallel to a refrigeration line for a short distance. Refrigerant cooled the oil, causing moist vapors to condense. Moving the oil pipe away from refrigerant line cured the trouble.

J H Squires *Newark, N. J.*

WATERCOOLED BEARINGS may have condensation in interior of bearing housing. In some plants the cooling water is extremely cold and it condenses moisture from the warm, humid air in bearing housing. Moisture runs down housing wall into the oil.

Reduce cooling-water flow so outlet temperature is about 120 F when inlet temperature is 70 F. Flow control may be automatic or manual.

I J Karassik *Harrison, N. J.*

LOOK FOR SEAL WEAR that permits steam leakage. Use a deflector disk on shaft to keep steam away from bearing. Install a thermometer in oil reservoir and hold oil temperature at 110 to 120 F.

Connect a vent to bearing or drain line to relieve vacuum that might pull air into bearing or oil system. Be sure all watercooling coils are submerged in oil or they may sweat at times. Ventilate reservoir with a small electric exhaust fan that draws an air current across top of oil. Also, collect water in a leg in reservoir's lowest part. Drain as often as necessary.

J B Turner *Toronto, Ohio*

GLAND LEAKOFF drain may be plugged, causing condensate to back up. Clean all drains. If turbine isn't fitted with a leakoff drain, install one.

Check slinger plate to see it works right. Look over bearing for cool drafts that may condense moisture vapor.

Edward Delnick *Valley Stream, N. Y.*

help the other guy cure his headaches

TYLER HICKS, *Associate Editor*

FLOOR CLEANERS in our plant splashed water from hoses into oil reservoir. More care in handling water hoses stopped this fast.

L R MEYER *Cincinnati, Ohio*

TEST OIL for moisture content. It's possible reclaimed oil is being used. A demulsification process takes place as oil temperature rises, allowing water to enter lube-oil lines.

J P DEMAS, SR.
Roselle Park, N. J.

SOME SMALL TURBINES do not have tight lids on oil reservoir. Air entering around lid may bring moisture with it.

Moisture from turbine seal can leak along shaft and enter bearing. Suction of oil pump may draw moisture into bearing.

Seal reservoir lid against entrance of air. Check seals in turbine and bearing to be sure there are no leaks. If there are, repair seals. If trouble still exists after these checks, install a small moisture-removal unit in oil-pump suction. If *KC* has the same trouble in all plant fans, a central reservoir with moisture-removal unit would be best solution.

A J BREUGELMANS
New York, N. Y.

PINHOLE in oil cooler may open at certain temperature, allowing cooling water to enter oil reservoir. Try to keep oil-cooler temperature at a fairly constant level to prevent this trouble.

Best cure for *KC's* headache is obtained by (1) keeping oil reservoir full at all times (2) preventing drafts from passing over cooler (3) keeping oil-cooler temperature steady.

H W CONGDON *Auburn, Mass.*

SMALL HEATER of the immersion type in oil reservoir cured this trouble for us. Breather tube was also installed and we changed oil so it had suitable viscosity at the higher temperature in reservoir. Thermostat keeps oil temperature constant.

KC would also benefit by using an oil purifier to remove moisture, sludge, metal and carbon particles. Oil lasts longer and does a better job.

L W FITZPATRICK
Jefferson City, Mo.

FIT A NIPPLE, 1x10 in., and a small cock to lowest part of oil reservoir. Drain regularly. Use only nonemulsifying oil.

P KNIGHT *Toronto, Canada*

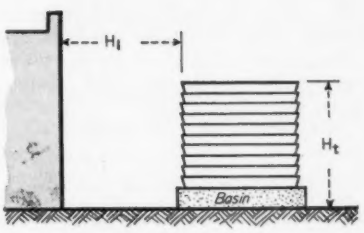
How Can We Cut Tower Windage Loss?

HERE ARE THE FACTS: We use a large amount of cooling water in our manufacturing plant. This water is circulated through cooling towers to reduce its temperature after it comes from plant heat exchangers.

Plant has six cooling towers: two forced-draft, two induced-draft and two natural-draft types. Windage losses in the two natural-draft towers are so bad windows in nearby buildings must be kept closed. Roof vents and other metal structures near these towers show more corrosion than those on other buildings.

How can we reduce windage losses from these towers? Is it possible to install fans on natural-draft towers and get the same cooling? Does windage increase delignification?—*BE, Oct Power*

Here Are the Answers



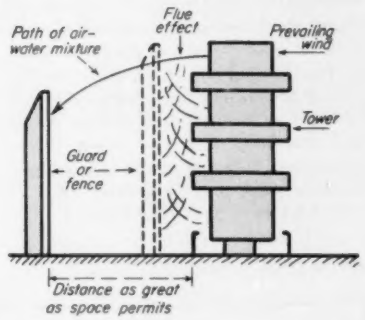
NATURAL-DRAFT towers are design compromises. This is necessary because to meet all atmospheric conditions found during tower life an extremely large unit would be needed. With this setup windage losses would be low but tower cost high.

To keep tower cost within reasonable limits and still have good performance a compromise design is worked out. In usual natural-draft towers windage losses can be reduced by installing boards in the main framework on the prevailing-wind side. Don't try this without first getting advice from tower manufacturer because you may change tower outlet water temperature on wind-free days.

When spotting natural-draft towers near buildings, H_1 should be equal to or greater than H_t, sketch.

JOHN CONSTANCE
Cliffside Park, N. J.

TURN TO page 132 for two new problems from *Power* readers



TOWER LOCATION can't be changed easily. One way to stop water from striking building is to use spray guards or a fence on the building side of the tower, sketch. Build the fence of wood or other material that resists the elements. Reinforce to withstand wind loads.

Have fence high enough to stop all spray leaving tower. Don't have fence too close to tower or you may get a flue effect causing turbulence and carryover of air-water mixture to nearby areas. Check horizontal distance spray travels and locate fence as far from tower as space permits.

Another solution is to install more fill in tower to reduce free area available for movement of the air-water mixture. Be sure to talk to tower builder before trying this scheme.

Fans can be put on a natural-draft tower. But before doing so, check free area available for air flow. With a small free area, air velocity through tower may be high, reducing cooling effect.

Induced-draft fans at tower top may need extensive reinforcement for support. Vibration may be a problem, too.

More PLANT PROBLEMS

Begins on page 130

Forced-draft towers have fan on tower base where static loads are more readily carried. Vibration isn't as much of a problem, either.

Cooling effect of mechanical-draft towers is controlled better than in natural-draft units. But cost of converting a natural-draft tower to mechanical draft may not be justified when you figure foundations, supports, fans and running expenses.

Reducing windage should cut delignification because there is less wetting and drying of the tower wood. If wood is continuously wet, there is less delignification in the cooling tower.

H B WAYNE *Brooklyn, N. Y.*

USE BAFFLES set at an angle of about 75 deg to air flow to reduce windage loss. Put inside tower, if possible.

DON COCHRANE *Milaca, Minn.*

WITH OLD TOWERS *KC* should consider using units of more modern design. Towers today have low windage losses, do fine cooling job in summer, winter.

Call in a tower manufacturer's engineer to get comparative prices. You'll find that cost of a new tower is low compared with its many advantages. Cooling range may be greater, too.

M J KENT *New York, N. Y.*

CONSULT MANUFACTURER before remodeling tower. Personally, I think *BE* would be smart to go to an induced-draft type. There's less drift, and cooling efficiency is better during summer when there's little wind. Air leaves tower at high velocity, traveling a considerable distance before mixing with atmospheric air.

Converting to mechanical draft will reduce delignification of tower wood.

A A HUNNEWINKEL *Woodstock, Ill.*

CHECK WINDAGE LOSS to see that it doesn't exceed that guaranteed by the tower manufacturer. If it does, he may be able to suggest some rearrangement that will reduce it.

It's usually more expensive to convert a natural-draft tower to mechanical draft than to buy a new tower. Check costs before converting the tower.

MELVIN EVANS *Chicago, Ill.*

SOLID WATER STREAM hit by wind can cause high windage loss. Check tower to see that water is broken into small streams. Use correctly placed baffles to diffuse entering air and water falling through tower. Check to see that tower isn't being overloaded with cooling water from plant system.

C G HOWARTER *Canton, Ill.*

WHY NOT CONVERT the natural-draft tower to an induced-draft unit? This cuts windage loss because pumping head can be made less. *BE* had best get design info from tower builder; figuring cooling towers is not simple.

L W FITZPATRICK *Jefferson City, Mo.*

DRIFT ELIMINATORS reduce windage losses. If *BE* doesn't have them in his tower he should put them in. If tower is fitted with eliminators, check to see they are in good condition.

Eliminators retard escape of water mixed with air, keeping loss at a minimum. Air-flow direction is changed twice before it leaves cooling tower. Wood strips make excellent eliminators.

This tower could be converted to an induced-draft unit to improve performance. Discharge from an induced-draft tower is at a higher velocity than from a forced-draft unit, giving greater dispersion in the atmosphere above nearby buildings. There's less chance of recirculation.

Mechanical-draft towers have greater cooling range than natural-draft units and are less affected by wind.

A J BREUGELMANS *New York, N. Y.*

(*Continued on page* 134)

YOUR TWO NEW PROBLEMS FOR JANUARY

1 How Can We Convert Our Heating Plant?

Our heating plant runs at 125 psi. For several reasons we have to convert the boilers to run at 15 psi.

Boilers are hrt units with a rating of about 5000 lb per hr. Each has two 3½-in. safety valves, one 6-in. nonreturn valve and one underfeed stoker.

We have no flowmeters, draft gages or CO_2 meters to show if boilers run at full capacity. About two-thirds of our heating load is on gravity returns, the rest is on vacuum returns. Heating steam pressure is 5 psi.

What changes are needed in safety and nonreturn valves to convert to 15 psi? Will a vacuum system be needed for returns that are now gravity? How can we find boiler output at different heating loads?—*LW*

2 Why Does This Motor Reverse?

Our overhead crane has a polyphase squirrel-cage motor for its drive. Recently it has started to give us trouble we can't cure without help.

Motor pulls its load until stalled, when it occasionally reverses and lowers load or pays off cable from drum until operator releases friction clutch. It then runs backwards until line switch is opened.

When switch is closed again, motor runs right at full speed. It may do this several days before it again stalls.

Current supply is 220 v, 60 cps. Motor is connected delta with the two coils in each leg in parallel. Nameplate rating is 10 hp, 60 cps, 220/440 v, 28/14 amp, 1680 rpm, 55-deg rise, 10-min time rating.

What causes this reversal? How can we cure it in our plant? What are good tests?—*GS*

Don't miss next month's problems. Another chance to use your ingenuity

Will you help readers who sent us problems? Extra pay for photo or sketches

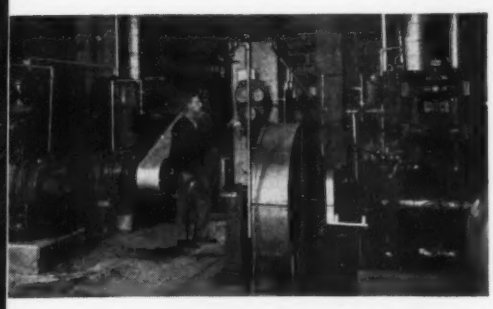
450 TONS OF ICE can be safely stored in this room. All of it is needed for concessions at Hershey Park and for domestic consumption. The supply is always dependable, thanks to Suniso.

THE HERSHEY BEARS AVERT A SCORE. The ice for this sports arena has been supplied with the help of a Suniso Refrigeration Oil for about six years. With a previous oil, compressor breakdowns were a constant threat to the sports program.

COMPRESSOR EFFICIENCY BOOSTED 15% BY SUNISO

The refrigeration compressors which service the Hershey Sports Arena, home of the Hershey Bears, are part of a central system which also takes care of an ice plant, frozen food lockers and cold storage rooms. About six years ago, the compressors were losing efficiency because of an inadequate refrigeration oil. It formed excessive lacquer and carbon deposits, which clogged the lines and made frequent overhauls necessary.

To solve the problem, management called in a Sun representative, and on his advice switched to a Suniso Refrigeration Oil. Suniso's natural detergency immediately began attacking the deposits throughout the system, carrying the sludge to traps and filters. Soon the system was entirely clean. Since then—over six years ago—the compressors have run at an overall added efficiency of 15 percent, and have always been equal to the heavy requirements made of them.



TEMPERATURES FROM −50F to +50F are supplied by these Frick ammonia compressors. They circulate brine through coils in the ice plant and under the arena floor, and ammonia through coils in the cooling and quick-freezing rooms. One grade of Suniso lubricates all of these compressors. Overall efficiency has been 15 percent better ever since its adoption.

75 TONS OF PEACHES AND APPLES are stored at 31 F to 35 F. Nearby are cold rooms protecting potatoes, cheese and raisins at 38F to 40F, powdered milk for chocolate at 40F; a quick-freeze held at −40F to −50F; frozen food storage at −6F to −8F. These rooms are all serviced by the same central system which handles the arena and ice plant.

SUN OIL COMPANY, Dept. P-1, Philadelphia 3, Pa.

If faulty lubrication is possibly costing you compressor efficiency, use this coupon to get: ☐ the services of a Sun representative, ☐ a free copy of the technical bulletin "Lubrication of Refrigeration and Air Conditioning Equipment."

Name_____

Title_____

Company_____

Street_____

City_____ Zone_____ State_____

SUNISO REFRIGERATION OILS

SUN OIL COMPANY, PHILADELPHIA 3, PA. • SUN OIL COMPANY, LTD., TORONTO & MONTREAL

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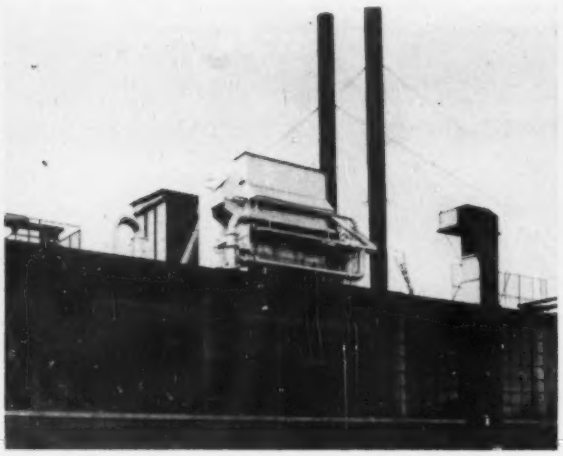
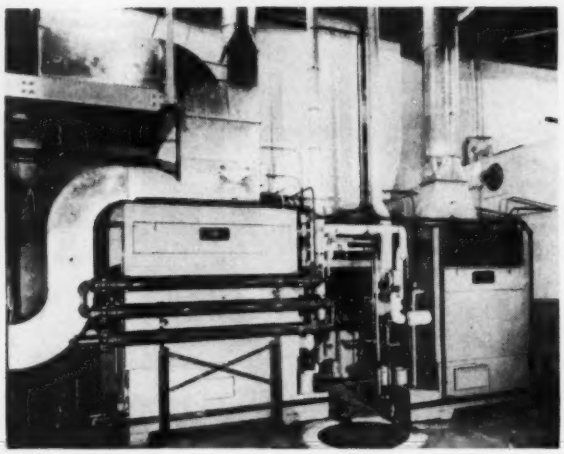
More PLANT PROBLEMS

Begins on page 130



EVAPORATIVE aftercooler mounts on the roof, does good job



ABSORBENT liquid in this drier takes moisture out of air

More Answers to Problem No. 2 from August 1952

INSTRUMENT-AIR DRYING is a critical problem today because so much production and manufacturing depends on pneumatically controlled devices. These instruments must perform right every minute of the year. Moisture that may cause freeze-ups, rusting or poor operation of instruments must be removed.

Either refrigeration or adsorption drying can be used for instrument air. But refrigeration has definite economic limitations besides needing some care for operation and maintenance.

Air, when leaving a refrigerated cooler, has less moisture than when entering, and its temperature is lower. Unless reheated, it is 100% saturated. If it passes through areas at a lower temperature, some moisture will condense in the air lines. Cooling air to a 40-F dewpoint isn't too difficult but below this the capacity needed rises sharply.

Adsorption drying reduces dewpoint of air without changing its temperature. At all times the air is far from a saturated condition and no reheat is needed. Positive protection against condensation of moisture at different temperature extremes is assured.

Highly saturated air leaving a refrigerated cooler can corrode and scale interior of compressed-air lines even though there is no condensation. Scale may flake off and be carried to the instruments. With adsorption drying the air is at such a low relative humidity corrosion doesn't occur.

Adsorption dryers have fewer moving parts, need less maintenance. For continuous service a dual installation is used. Operation may be made fully automatic if you desire it.

J R Clark
Pittsburgh Lectrodryer Corp, Pittsburgh, Pa.

TWO OTHER METHODS of removing moisture from atmospheric air are: (1) drying air with a liquid absorbent—a continuous process (2) evaporative cooling in apparatus especially designed for compressed-air or gas aftercooling. Method 2 is preferable for compressed air used in tools and instruments.

Evaporative aftercooler, photo above, left, in discharge line between compressor and receiver does a good job. High-temperature air passes through a cooling coil in a watertight casing through which a blower forces outside air. Water is sprayed continuously over the coil, cooling the compressed air by evaporation of moisture.

In this setup the compressed air is always cooled to within a few degrees of the atmospheric wet-bulb temperature. This is lower than the dry-bulb temperature of the atmosphere. No additional cooling takes place in the air lines, nor is there any further condensation.

In winter, automatic control of amount of air entering spray chamber prevents freezing. Control element also activates a heating element, when necessary.

Experience with a large number of installations shows this method of moisture removal has low first cost. Only maintenance needed is the cleaning of the cooler surfaces at regular intervals.

Photo, above right, shows a typical unit using a moisture-absorbent liquid. It removes moisture from air as a separate function from cooling or heating, gives precise control at all times. This is classified under type 1, above.

D R Ward
Niagara Blower Co, Chicago, Ill.

MOST MOISTURE causing trouble in instruments can be removed with a pipeline-type separator installed in compressor discharge line ahead of receiver.

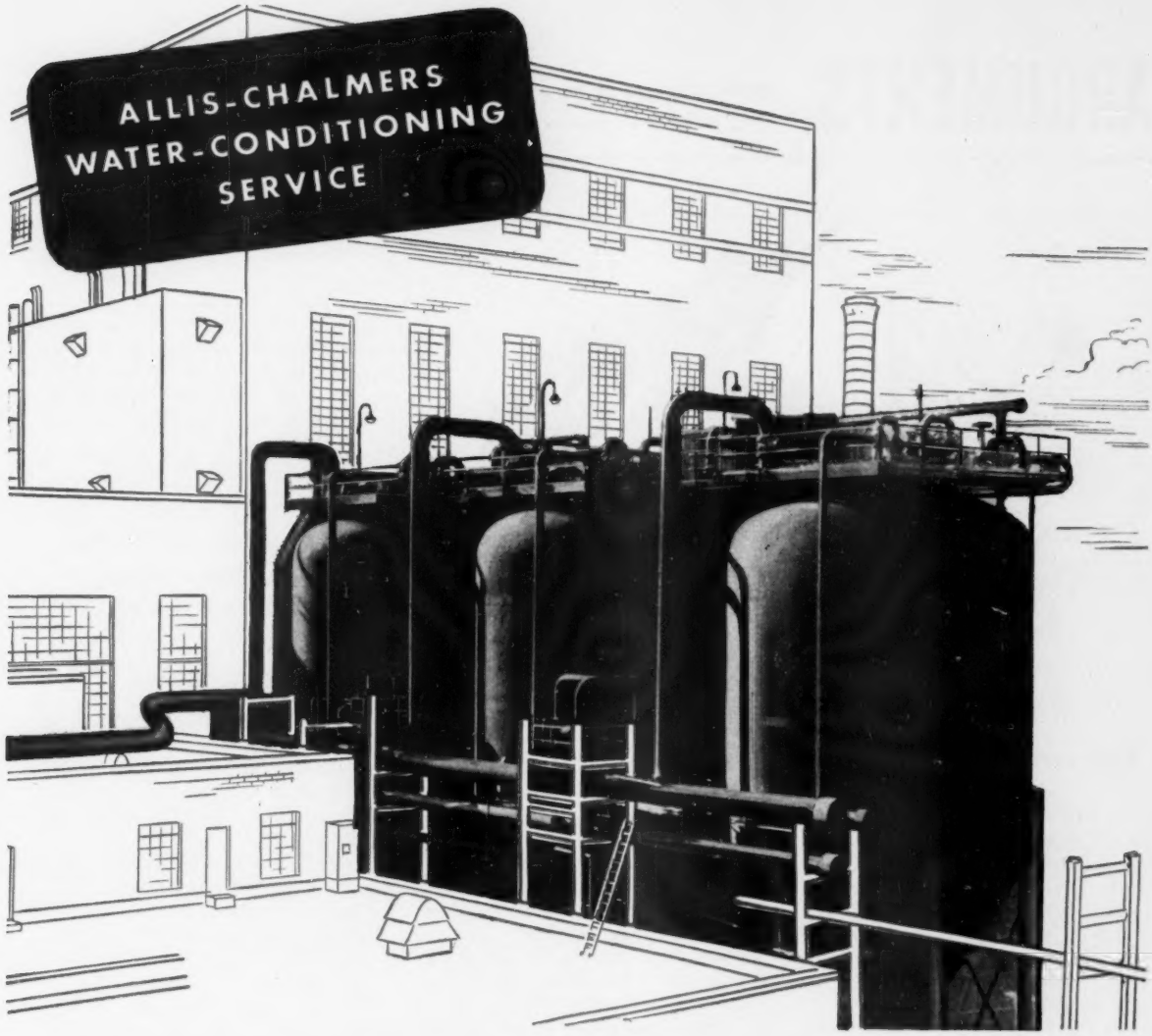
Assuming intake air is saturated at 70 F, it contains 1.2 lb of water per 1000 cu ft. Compressing this air to 175 psi and cooling to 70 F in the aftercooler reduces moisture content to 0.085 lb per 1000 cu ft. This is only 7% of the incoming moisture.

As average aftercoolers reduce leaving air temperature to within 12 to 15 F of entering water temperature, cooling shown above can be accomplished with water at 55-58 F. About 2 gpm of water is needed.

Cooling air to 40 F only reduces moisture to 0.025 lb per 1000 cu ft. Slight additional moisture removal isn't usually warranted and may be quite expensive if it involves using refrigeration.

Dual-adsorption units cost four to five times as much as an aftercooler. With an aftercooler you can remove 93% of the moisture from the air with low first cost, and low installation and maintenance costs. Efficiency is good.

J F Craig, Jr.
Worthington Corp, Harrison, N. J.



WATER HARDNESS CUT TO ZERO

at record rate of 240,000 gallons per hour!

THIS king-size, outdoor water-softening system was recently installed by Allis-Chalmers to meet the special needs of a leading midwest oil refinery. It furnishes four high-pressure boilers with filtered treated water at the extraordinary rate of 240,000 gallons per hour — the largest water-softening system ever installed in a refinery power plant.

Extremely rugged and designed for year-round operation outdoors, this Allis-Chalmers system has been in service about four years. There have been no breakdowns, and maintenance costs have been practically nil.

Whatever *your* industry—paper, petroleum, food, steel—you'll get prompt, convincing results with Allis-Chalmers Water Conditioning service.

For over 50 years Allis-Chalmers has been building power generation equipment. This experience is invaluable in providing our water conditioning specialists with the extensive background needed today to recommend correct equipment, chemicals and service.

An expert representative is available, ready to recommend proper chemicals or help select the right process for your power plant requirements. For complete information, contact your nearby Allis-Chalmers District Office, or write Allis-Chalmers, Milwaukee 1, Wis.

A-3916

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ARGUMENTS

Here's the place to unload your gripes to editors, manufacturers and fellow engineers

Bilgewater on Marmaduke's Popping Safeties!

Noo, MARMY, what I want tae ken is this. Whit kin' o' boilers did the shup in your November yarn hae, when the safety valves popped as ye said? The steam went up the escape pipe, an' very little to the steam line. Lord all michty, mon, wis the steam line connected tae the safety valve escape pipe?

A schulbairn kens that pressure is pressure, and in confined places like bilers, wi' steam lines connected, the pressure is everywhere. So if the safety valves popped wi' aboot a drap in pressure o' five pun' there wad still be aroon 230 psi at the steam chest. Noo, there is a possibility that the engine *micht* stop on dead center, if, and only if, the throttle valve (butterfly valve as ye ca' it) swung shut during the vibration caused by a racin' engine. This cud be so, owing tae the rattle traps bilt during the war. (EDITOR'S NOTE: Butterfly valve had *not* moved.)

Lookin' at it frae a sensible p'int, whit wuz yer puston clearance on yere high-pressure cylinder? Anither question. Whit wuz the lead on yere puston valve? I'm askin' the questions as I've seen terrible valve settin' din. Equal leads, stuff and nonsense! Did ye never tak' yer engine apairt?

DONAL' GLENCANNON
S S Inchcape Castle
(Brother of Colin Glencannon)

More Bilgewater

SURFACEBLOW'S November story has a flaw, and it seems to me to be this:

Safety-valve-mechanism inertia may allow steam header pressure to drop *slightly* below 232 psi, but not enough to stall the engine. Reduced pressure should at best slow down the propeller, as propeller resistance drops with the square of falling rpm.

Bilgewater on snap decisions!

K A TRAUB *Detroit, Mich.*

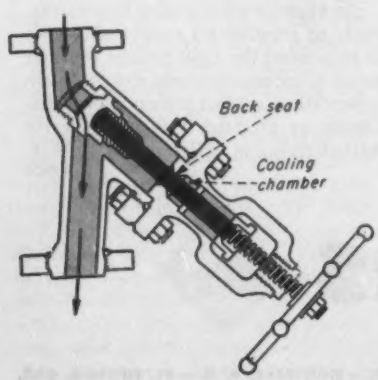
Hoot, Mon! Dinna Ye Hae Fire Under Yere Biler?

AH, FOOSH to this mon Marmaduke, tha surfaceblower! Wi' all his blather in November aboot high steam and low steam, inny thurrd-class oiler wi' eyes in his noggin wud ken that as long as the old ship had headway, tha drag of tha propeller when she hits tha drink wud turn tha old grinder off dead center. Wi' his poppin and apoppin o' his safety valve, dinna he have no fire under his biler?

If old Marmy wud lay offa that concoction of lye and bilgewater he swigs as Sandpaper Gin, and stick to tha pure, sweet taste of Groggins' Mountain Dew, he wouldna do sich tall explaining.

COLIN GLENCANNON
SS Inchcliffe Castle

CORRECTION: On p 142, Dec POWER, J C Ferrante says, "It reads zero when motor is dry." This should be, "Good reading is one megohm or better per 1000-v motor rating."



Valve Flow Reversed?

Normally blowdown valve is arranged with the flow reversed so pressure is against the bonnet and closing the valve. Thus, in the event of a broken valve stem, the valve will close.

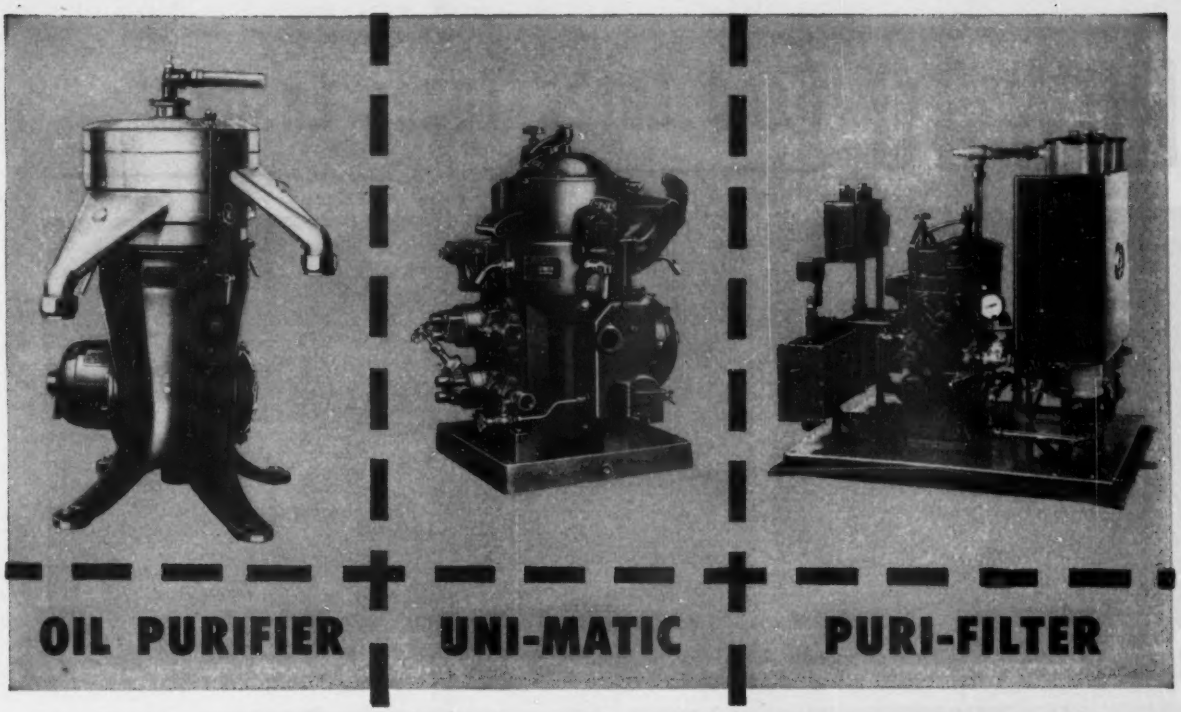
We are, therefore, of the opinion that the arrows showing flow through valve, (fig. left), should be reversed.

W RYAN *Salina, Kan.*

EDITOR'S NOTE: If this valve was installed with the pressure on top of the disk instead of the way we show it, we're afraid the boiler operator would be in for trouble. For one thing, when he got ready to blow down his boiler, he would not be able to open the valve. Reason is that the opening above the disk would act as a trap for sludge and sediment. Eventually it would harden into a mass, making it impossible to blow down the boiler. Besides that, we believe there is a code requirement that valve must be installed as shown.

Blowdown valves must work when they are needed. For this reason, some of the older blowdown valves on marine boilers were the port type. There was no seat to collect sediment and stick.

Let's hear from readers on this.



WHICH ONE?

De Laval Oil Purifiers are supplied in types and sizes for every plant need. *All* types . . . straight Oil Purifier . . . "Uni-Matic" Oil Purifier . . . or "Puri-Filter" . . . perform the same basic function equally well — they all throw out of the oil by means of centrifugal force, all solid and liquid impurities. But each machine has its place.

The straight Oil Purifier is used where it is desirable to install separate pumps to carry the oil to and from the purifier. This type of De Laval machine comes in the widest range of capacities, from 5 gph to 1800 gph dependent on the viscosity of the oil being purified.

The "Uni-Matic" is built with its own pumps. When necessary, a heater is also supplied. It is ready to operate as soon as it is piped up to the oil supply.

The "Puri-Filter" is a complete De Laval "Uni-Matic" plus a set of three or more filters. The filters remove colloidal carbon and other minute contaminants that get into diesel oil, or remove fly ash from turbine oil. Because it combines centrifugal force and micronic filtration, it leaves oil visibly clean—practically transparent. Its capacity depends on that of its basic unit —the De Laval "Uni-Matic" Oil Purifier.

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

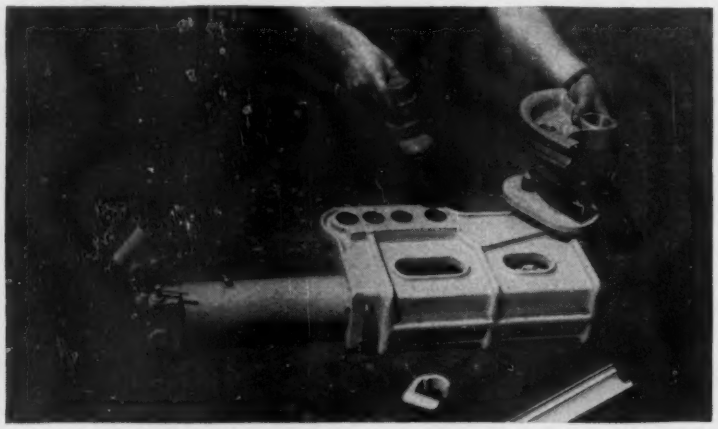
DE LAVAL OIL PURIFIERS

FOR MORE DEPENDABLE POWER PRODUCTION

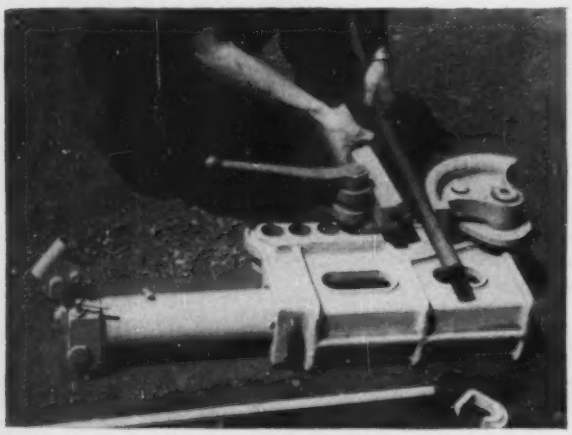
HOW TO Bend Large Tubes Easily

Courtesy, Tal Bender, Inc, Milwaukee, Wis.

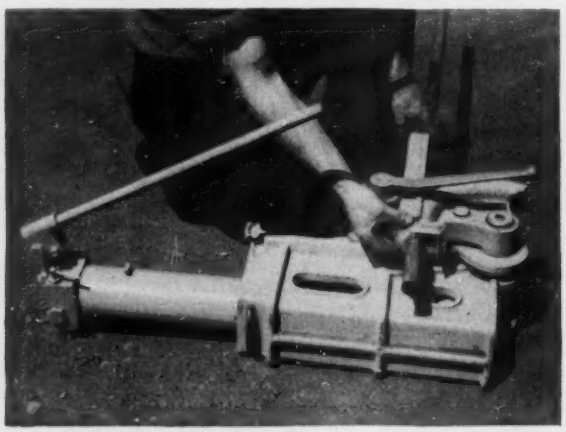
1 Assemble hydraulic pump unit to tube bending frame with U-key. It's simple



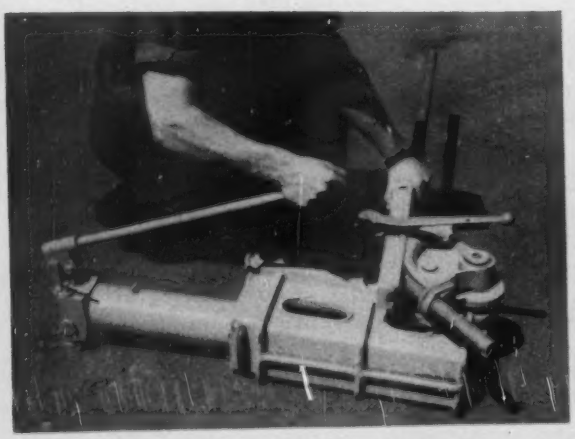
2 Place the bending former for needed tube size to be bent on bell crank. Next insert crank handle into hole that is marked with corresponding size



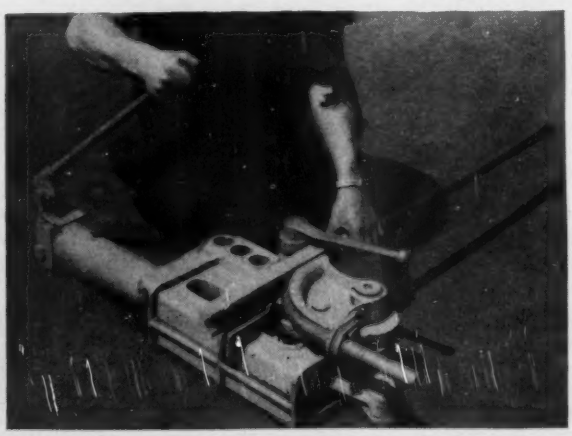
3 Place the tube to be bent between the former and the slide bar. Slide bar is marked with degrees to show right bend



4 Slip the grip over tube, onto former as shown. Then turn crank handle into closing position to hold tube in place



5 Work the hydraulic pump handle to bend pipe, keep eye on indicator to see degree of bend. Here it shows 45 degrees



6 Keep pumping until 90 deg needed here is reached. One hand on this pipe does job. Benders also come in large sizes

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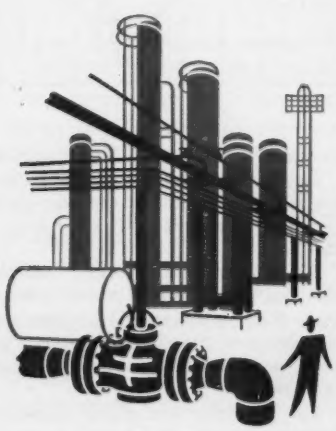
*WICKES steam generators are cutting costs in America's finest refineries and natural gasoline plants



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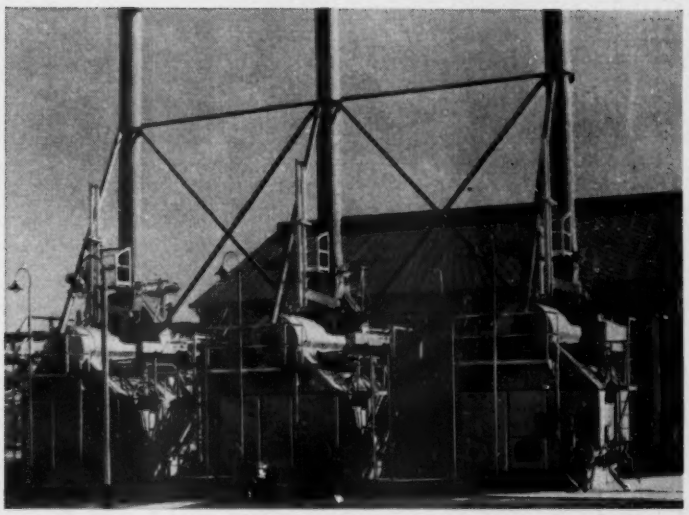

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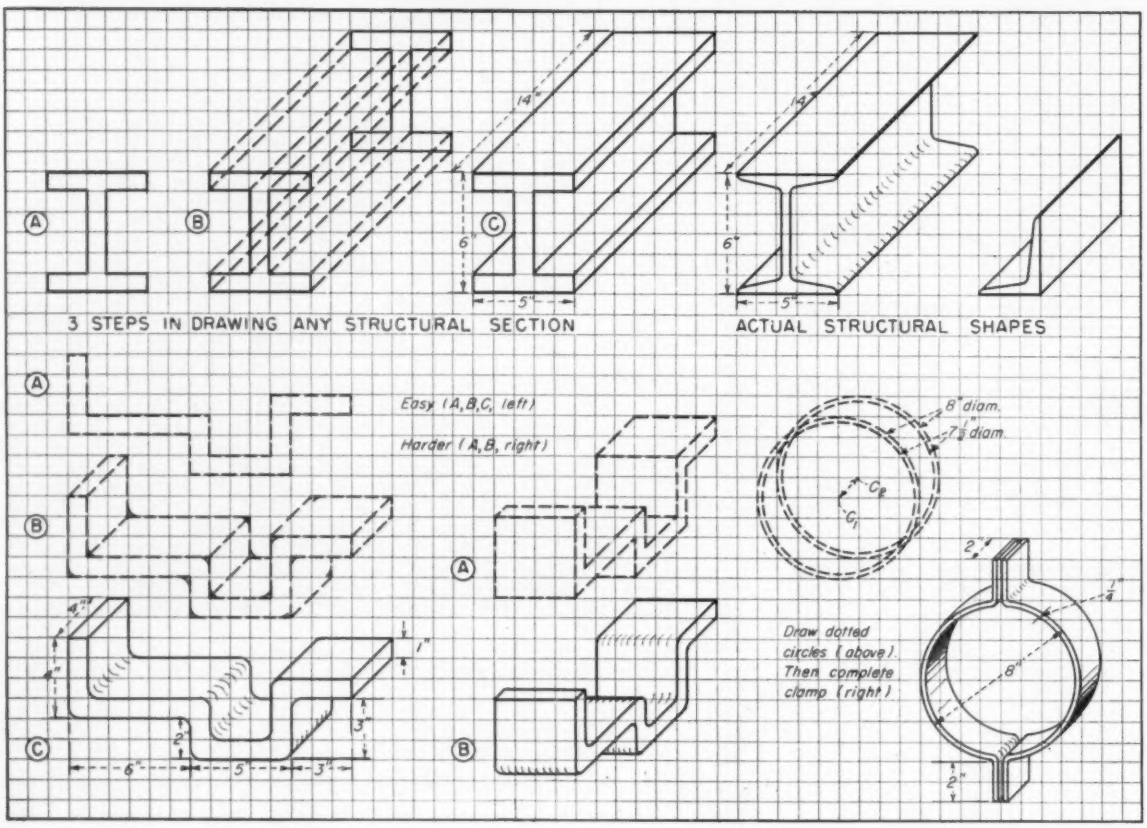
HEADWORK

PHIL SWAIN BRINGS ENGINEERING THEORY DOWN TO EARTH


3 STEPS IN DRAWING ANY STRUCTURAL SECTION
ACTUAL STRUCTURAL SHAPES
Easy (A,B,C, left)
Harder (A,B, right)
Draw dotted circles (above). Then complete clamp (right)

Easy Sketching System—5

► IN PLANNING your sketch, always try to put the difficult face toward you because you draw this in its true shape. Working this way saves time and trouble.

For example, in a structural shape (I-beam, tee, ell, channel, etc), sketch the beam with the end toward you and draw this end true. Sketches *A B C*, top left, show the three steps for a simplified I-beam.

Actual structural shapes are shown at upper right. Just draw the true section of the facing end, then carry the edge lines back at 45 deg to a duplicate outline for the back end. Erase the lines that don't show. Heavy up those that show. If you want, add a little shading to dress up your sketch.

In practical engineering, it's often necessary to have a blacksmith or other mechanic bend up an iron strap. How to sketch such a job is shown by *A B C*, lower left.

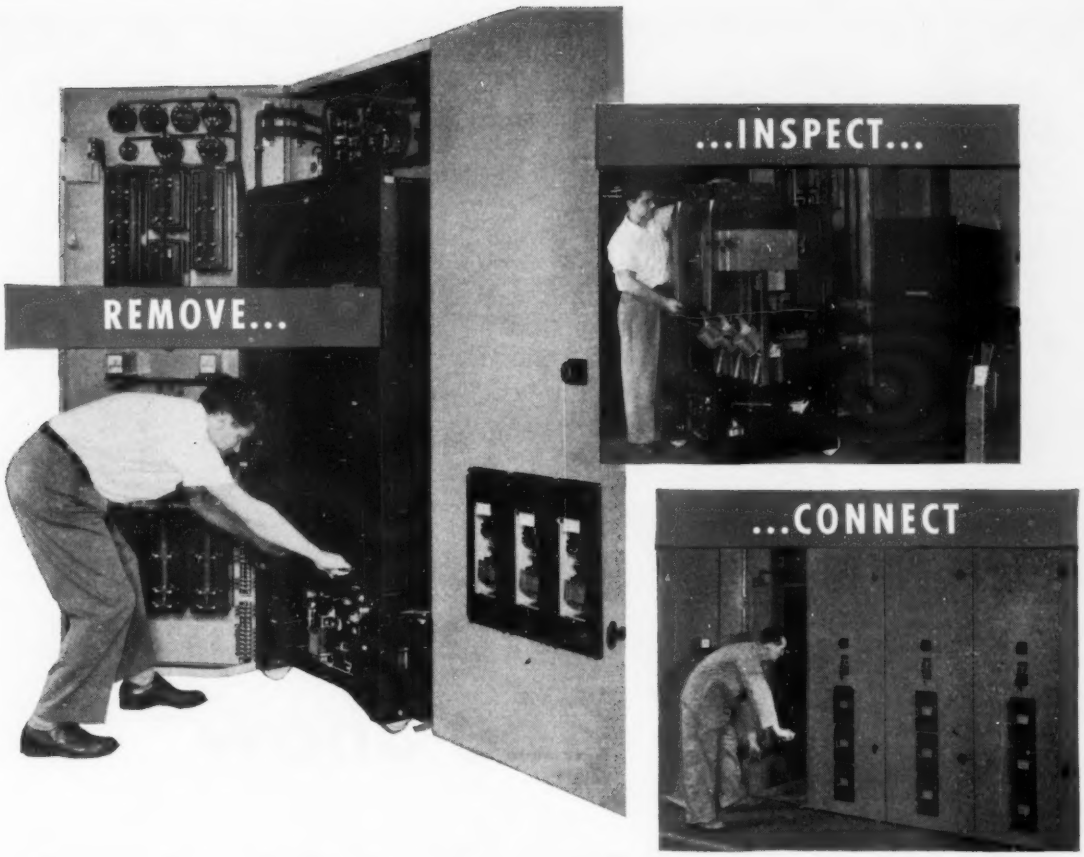
Note that the pieces are turned so the irregular edge faces you—again for easy sketching. For better looks the fillets may be drawn in.

Best sequence is to draw the complete piece in very lightly with sharp corners. Then draw the fillets heavy. Finally, complete the heavy straight lines and add some shading if you wish.

Lower center sketches *A* and *B* show the same piece with one end facing you. See how much harder it is to draw it this way.

Where circles are involved, "cabinet" sketches are generally much easier to make than isometrics. If you can turn the object so the circles face you, you can draw them true with an ordinary compass.

For example, the clamp shown at lower right seems to be quite a complicated sketch, yet there's nothing to it. Draw front-edge circles around center *C-1*, and back edge circles around *C-2*. Draw them light first. Then sketch in lightly the top and bottom flat extensions. Finally, heavy up all lines that show, and erase all that are hidden.



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"He had a cargo sling lower three heavy suitcases into a sampan below."

Grogan Stops The Show

► WHEN THE NEW SUPERLINER SS *United States* pulled out of Pier 86 on her maiden voyage recently, some of us POWER editors went down to watch her depart.

After she backed out into the stream and headed toward the Narrows, we left the shouting crowd and made our way to Bedlam's Bent Propeller Bar around the corner.

Most of the water-front characters had beaten us to the draw, for the bar was already crowded. Seemed that everyone was talking at the same time. About what? About first voyages, blue ribbons, and about the various crossing records. Even Robert Fulton's first voyage was towed into the arguments.

Only one person, Marmaduke Surfaceblow, consulting engineer extraordinary, kept out of the noisy chatter. He leaned on the bar, staring at the bottle of Sandpaper Gin before him.

"The *United States* might make a record crossing, but I was chief of one vessel that never missed a sailing date," announced an old-timer standing next to Marmy.

"Bilgewater on keeping sailing dates," barked Marmy, suddenly coming to life. "I'll tell you about First Assistant Engineer Tuffy Grogan, who kept his ship from sailing for two days while he engineered a big deal ashore."

That did it. Things quieted down in a hurry, for Marmaduke Surfaceblow was evidently about to sound off. Marmy slowly pulled himself up to his full six-feet four-inches height. Then he looked belligerently around at his expectant audience and started blasting away.

"Back in 1901 I was third assistant engineer of the SS *Mongolia Queen*," barked Marmy. "She was the flagship of the old American Asia Line, with home offices in San Francisco.

"The *Mongolia* had two 4-legged triple-expansion engines and six double-ended Scotch boilers. Each engine had a 50-inch-diameter low-pressure cylinder at either end, with a high- and low-pressure cylinder in between. Those engines were 3400-hp apiece, and cranked away at 120 rpm on 220-psi steam.

"They were the pride and joy of Tuffy Grogan, her first assistant engineer. Grogan was a marine engineer what was a marine engineer. A big two-fisted Irishman, Tuffy had the reputation of being the noisiest first assistant —with the quietest engines in the line. And he would square off and bust the first guy who hinted that he had sailed with quieter machinery.

"When Grogan was down below at sea, he was always whipping his flashlight out of his hip pocket and placing one end against an engine column. Then he'd press his ear against the glass and listen. After spending a few minutes at various columns, he'd put his 'stethoscope' into his hip pocket, come over to the log desk and address me as seriously as a doctor announcing his decision after an important diagnosis.

"'Third,' he'd say, "When we hit Singapore tomorrow morning, I want you to key up on the port engine's hp crank bearing. If you have time before the deck department is through working cargo, you'd better take a few thousandths out of the starboard forward low-pressure crosshead for good measure.'

"Grogan was usually right. He caught the slightest noisy bearing before it had a chance to develop into a knock. But he was a sharp operator in more ways than one. He had all kinds of rackets ashore. That included everything from selling scrap-bronze condenser tubes, old valves and brass piping, to doing a little smuggling of firearms and cigarettes.

"He'd go ashore in Shanghai and not show up for several days, until just before sailing time. Then he'd return with two or three natives following him up the gangplank, all loaded down with packages.

"We pulled into Shanghai one trip, only to learn that our usual five-day stay had been cut to two days. That upset Grogan's plans and he was burned up plenty. Seems he had a 'big deal' working ashore and had already

(*Continued on page* 208)

OIL-FREE COMPRESSORS

VACUUM PUMPS and BOOSTERS

Right above: Five JOY WNO-112 Oil-Free Compressors for pressure-testing of food containers, oil-free ejection of metal stampings, paint spraying and general oil-free processing service.

Left foreground: Three JOY WGV-9 Vacuum Pumps handle the job of vacuum feeding of metal sheets.

Left background: These three JOY WGB-9's boost gas pressure for the burners in the soldering process.

WAD 1-4016

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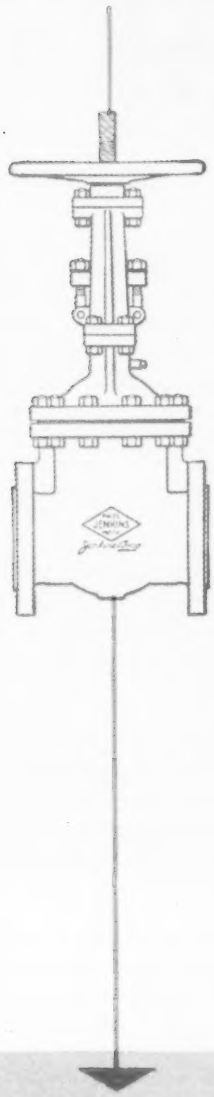

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DEFENSE DIGEST

Your roundup of mobilization news and trends affecting power men

Tightness of power supply seems likely to be with us for some time yet – not until 1956 can we expect any real improvement in reserve margins. Construction of new plants just hasn't kept pace with schedules. One big reason is delay in delivery of generating equipment, largely a result of materials shortages. Some of these stem from last year's steel strike, but a big and continuing factor is the priorities setup, which rates military and atomic-energy programs ahead of "defense-supporting" industries like power.

Atomic-energy expansion puts another crimp in the power program. Many large new AEC facilities need interim power service until their own generating equipment is operating. These loads will put heavy drains on widespread areas.

Shrinking reserve margins are predicted for both 1953 and 1954. This year looks to be much like 1952, but somewhat worse. Forecasts for 1954 indicate a peak-up of heavy demands just when the effect of delays is being felt most strongly. If this pessimistic view is right, the going in 1954 will be about as tough as it's ever been. Things may look up in 1955, and by 1956 we should be back on the beam, beginning to fatten up those thinning reserve margins.

Better use of engineers looks like the only immediate answer to the shortage that will continue for some years. A recent survey by the National Society of Professional Engineers shows many engineers doing work not requiring their specialized skills and training. But NSPE is encouraged because a good number of companies are studying how well their engineers are being utilized and looking for ways to use them most effectively. What are you doing?

John L. Lewis got it – President Truman reversed his own stabilization authorities and approved the $1.90-per-day wage boost previously negotiated with the operators. With the market still soft and coal stocks still high, it's unlikely that the wage rise will make much immediate difference in prices. But it will undoubtedly make life tougher for some of the less efficient operators.

Orderly removal of controls is still getting a lot of study in mobilization agencies. Situation on most controlled materials looks promising, but dismantling the machinery too soon looks risky. Mobilizers seek to get a withdrawal procedure all worked out so they can take action quickly some time during the second quarter of 1953, if circumstances are favorable at that time.

Fresh water from salt is the object of a long-range research program being undertaken by the Dept. of the Interior. Nine outstanding leaders in science, education and industry have accepted invitations to advise the Department in its future studies. One of the nine is Sheppard T Powell, well-known consultant, familiar to **POWER** readers for his comprehensive articles on water treatment. While seawater conversion is the major object of the program, ways to treat brackish water will also be sought, with an eye to widespread irrigation needs.

Power conservation in the Pacific Northwest (DD, Dec 1952) will be guided by J H Gumz as area representative of Defense Electric Power Administration. H A Lee will assist him. Both have long experience with Pacific Gas & Electric.

FOR PART LOADS

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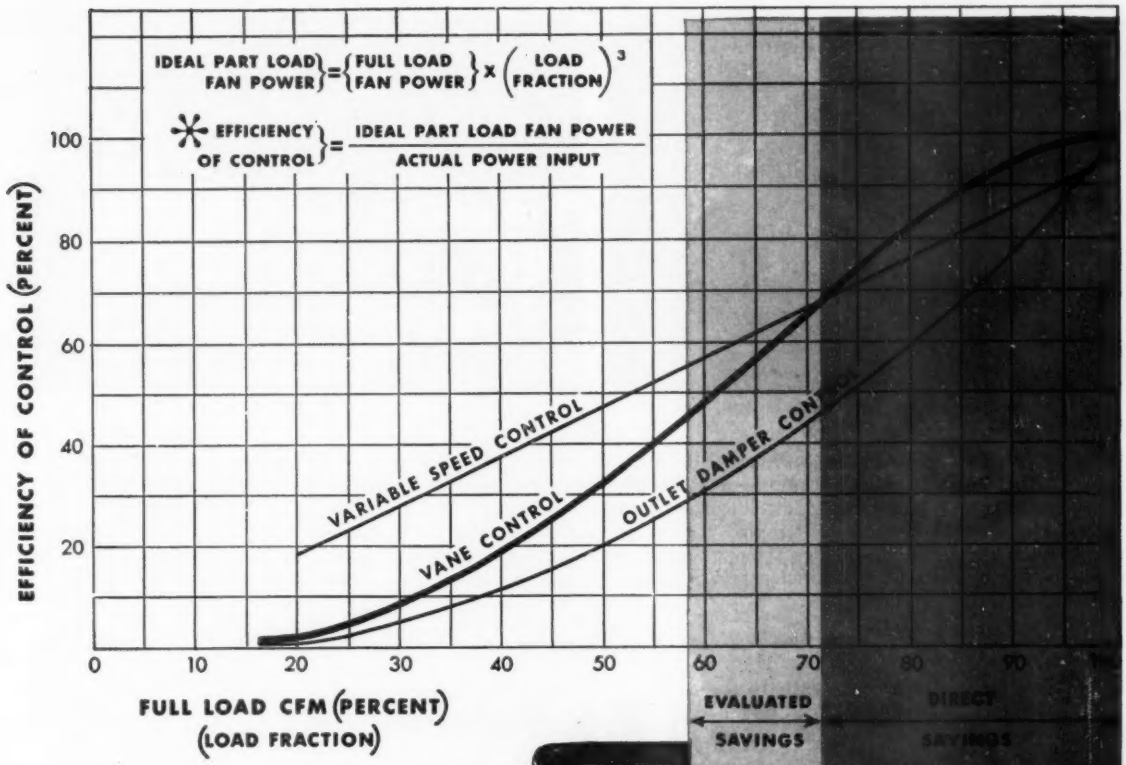

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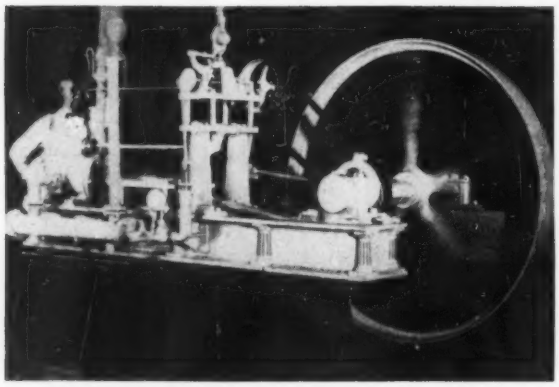

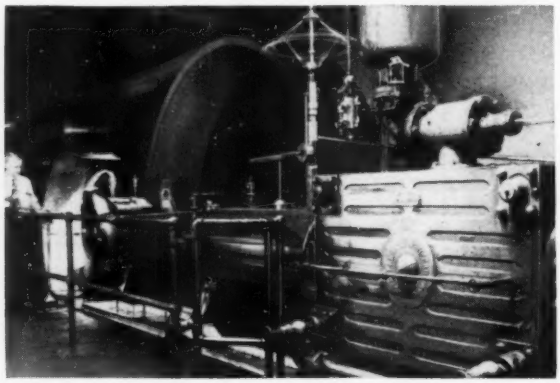

Frick Co Begins Second Century

Special publication issued by Frick Co, Waynesboro, Pa, to celebrate its Centennial of business features some 200 photographs, drawings and documents of direct connection to that firm's existence over the past one hundred years. High among the interest items are the photographic record of the steam engine and compression refrigeration system developments. Photo, above, left, is a steam engine built in 1856 and now housed at the Ford Museum, Dearborn, Mich. It has a cylinder of 6 in. bore, a 13 in. stroke, and a rating of 10 hp running at speeds of 75 to 90 rpm. The second photo, right, pictures a Corliss engine built around 1891. It has a 22 in. bore, a 4 ft stroke, and is still in daily operation.

Hydro Power Offers World Wide Promise

McGraw-Hill World News—Most of the world is badly in need of power development and every effort is being made to tap all possible sources. One of the most immediate to all areas of the world are hydro power.

Japan, for example, has recently set up a semi-governmental Electrical Power Sources Development Corp and under its sponsorship it plans to construct dams and power stations on seven large rivers.

Sakuma Dam is to be built on Tenryu River in Shizuoka prefecture, Mihoro Dam on Shokawa River in Gifu prefecture, Okutadami Dam on Tadami River in Fukushima prefecture, Nukabira and three other dams on Tokachi River in Hokkaido, Kamishiiba Dam on Mimikawa River in Miyazaki prefecture on the island of Kyushu, Igawa and Okuizumi Dams on Oi River in Shizuoka prefecture and Sudagai and Yagisawa Dams on Tone River in the north of Tokyo. In the place of Okutadami Dam project, there is an alternative plan of three Yunotani Dams on the same river but in the neighboring prefecture of Niigata. Competition between the two plans is now a complicated political issue involving local interests in each prefecture. Whereas the Okutadami plan will cost $59,000,000, the Yunotani plan will need $106,000,000. Of these plans, works were already started on Kamishiiba in 1950 and on Igawa and Okuizumi in 1952.

The State of Sau Paulo in Brazil, as a second example, expects to enjoy the electric power produced from a project just approved by the Joint Brazil-U. S. Commission for Economic Development.

Two new generators will go into the Catunduba Power Co central plant at Avanhandava on the right bank of the Tiete River. The new generators will boost capacity to a total of 13,800 kw.

The rapidly expanding domestic, urban and industrial power requirement of the Greater Lima, Peru, area is increasing at the rate of 9% per year, in comparison with most large cities which increase at the rate of 7%. To keep pace with this trend the local utility company, Empresas Electricas Asociadas added early this year 60,000 H. P. of hydroelectric power to its system by the inauguration of the Juan Carosio-Moyopampa plant in the Andes Mountains.

The new "Juan Carosio-Moyopampa" plant is part of an integrated system designed to develop the maximum hydroelectric capacity of the Santa Eulalia and Rimac River drainage basins, in the central Andes east of Lima.

Special Water Board Formed

Prominent members of both political parties as recently as this past June backed the passage of Public Law 448 authorizing the Dept of Interior to carry out research in saline and brackish water purification. There is scarcely a State that would not benefit from development of an economic process for reclaiming this class of water.

In one of the last acts of the old administration the then Secretary of Interior, Oscar L Chapman, announced the appointment of an advisory water study board staffed by nine outstanding leaders in various fields of science, education, industry. These men are to ad-

(*Continued on page* 203)

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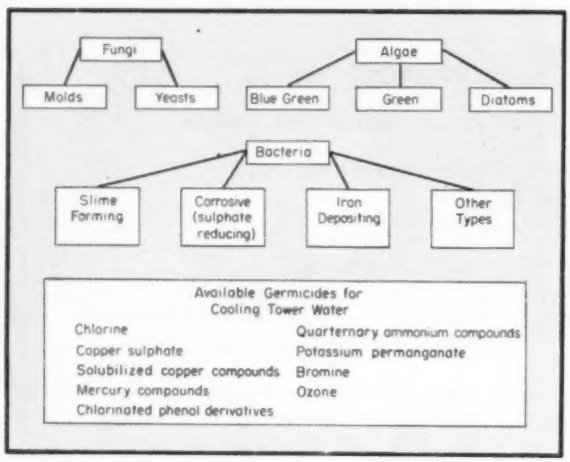

1 Principal organisms causing slime formation in cooling towers can be handled by chlorination or algicides above

Method of Controlling Calcium Carbonate Scale

	Material	Function
1	Acid treatment (Sulfuric acid, sulfur burning, recarbonation, hydrochloric acid)	Neutralization of carbonate alkalinity or reduction to desired positive stability index
2	Organic dispersives (Lignin and tannins)	Colloidal treatment—5 to 25 ppm required to dispose precipitated calcium carbonate and retard accumulation of future deposits
3	Zeolite softening	Reduction of calcium content
4	Lime and lime-soda softening	Reduction of calcium content and alkalinity
5	Glassy phosphate	Threshold treatment—2 ppm metaphosphate residual stabilizes highly supersaturated solution of calcium carbonate and calcium bicarbonate

2 Major scale producer—calcium carbonate—can be controlled by any one of five approved methods tallied here

Cooling Towers

The Effect of Circulating Water on Wood In Cooling Towers. *By J C Hill, Esso Standard Oil Co, Baton Rouge, La.*

The author's plant uses 125,000 gpm of river water much of which supplies once-through cooling service. But overall economy of a water with more even temperature and less scale-forming tendencies makes cooling towers a valuable tool at this refinery. About twenty, in all, are working. All are redwood and they vary widely in age. No tower has been replaced in its entirety, but every component part of different towers has been replaced separately.

Lumber deterioration rates as a major maintenance factor. This condition seems especially prevalent throughout the Gulf region. As a result the Cooling Tower Institute is questioning users in this area for data of all sorts to establish common denominators in good practice techniques to minimize this deterioration.

The author simplifies the problem into two principal courses: (1) erosion or wearing action from the tremendous volume of water flowing over cooling tower lumber (2) biological action of fungi, plus instances of termite and caddis worm attacks on the wood.

As a possible solution the wood employed might be pressurized with certain chemicals. To this end the author's company are putting in test racks of a number of woods treated with various chemicals.

There are still other possibilities; principally, revision of water treating standards and, even more drastic, complete redesign. This step is underway on towers now available by using different materials including concrete. Chemical stoneware (Berl saddles) is replacing lumber in mist eliminators. *ESWP Paper. No number.*

Bacteria Growths and Their Control. *By R S Wise, National Aluminate Corp.*

What organisms cause slime to form in cooling towers? The author selects those in Fig. 1 as the principal culprits. They get into the cooling tower in the makeup water or through the air. Those that get in from the tower material are temporary causes present only with new towers.

There are a number of ways of coping with them once a tower is in operation. By far the most widespread is the system of chlorination. But there are a range of algicides which you can employ depending on whether you want to inhibit organism growth or kill it off entirely. To inhibit the organisms means that a sterilization procedure should proceed the inhibitor. That way the existing slime, which would continue at its present size under inhibition, would be effectively dealt with.

But no matter what method is selected there must be a basis of research or previous experience on which to base a selection. Without it the attendant problems of safe-handling, effective control, frequency of application can trip up the shrewdest guess. *ESWP Paper. No number.*

Deposits and Their Control in Cooling Tower Waters. *By George Illig, Hall Laboratories.*

Deposit build-up may be due to precipitation of some sparingly soluble substance such as calcium carbonate; the accumulation of products of corrosion such as metallic oxides; the settling out of sand or other suspended matter; the fouling of equipment with organic growths or any combination thereof. The author gives particular attention to the control of scale build-up.

A variety of methods of dealing with the major scale producer—calcium carbonate—has been developed over the

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Begins on page 150

years, Fig. 2. The author discusses their use and limitations.

The most recent (both about 15 yrs old) are the "controlled scale deposition" method band on the Langlier Saturation Index and the "threshhold treatment" employing a glassy phosphate.

The Langlier system depends on establishing a thin but dense coating of calcium carbonate to protect metal surfaces against corrosion but not cut down too greatly on heat transfer. But because there are wide variations of water temperature within a single cooling system, the job of laying down the most desirable uniform layer is often complicated.

The glassy phosphate method is held to be simpler in application. It must be remembered, however, that there is a definite limit to the amount of hardness you can stabilize with glassy phosphates, and supplementary treatment methods are often in order. *ESWP Paper. No number.*

A Review of Testing Techniques in Cooling Towers. *By J K Rice, Cyrus Wm Rice & Co.*

Testing procedures for determining the effectiveness of cooling water treatment may be classified as: (1) coupon (2) sample unit (3) full scale. Any one of these procedures may be used singly or in conjunction with one or both of the other two depending on completeness of desired information.

Coupon procedures are the most familiar. They are the ones in which a relatively small sample of the material is subjected to a given environment for testing purposes. Results, though, cannot be taken as relative to results in actual full scale operation unless and until a direct correlation is obtained in each particular environment.

A sample unit is a small portion of a full scale system wherein the sample is dimensionally similar and subjected to the identical environment of the full scale unit. As an example, the sample unit might be a section of pipe, tubing, valve or fitting. Chief disadvantages are cost of sample, job of removing and inserting them in the full scale environment, and cost of operating them.

Full scale unit procedures are the final, and for a given environment, the only accurate procedures. The measurements you take with a full scale unit are operating data, costs, hours between cleanouts, cost of cleanouts, tube life, changes in water side heat transfer. *ESWP Paper. No number.*

Water Treatment

Deionization vs Evaporation of Hard Water Supplies For Boiler Makeup. *By T C Happe and R A Russell, Black & Veatch Co.*

The authors feel that the subject of deionization of waters with less than 150 ppm of dissolved solids has been widely discussed and its advantages well known. There is, though, a scarcity of data on deionization of waters of 500 ppm of total dissolved solids and above.

Makeup water of acceptable quality for the higher ranges of boiler operating pressures can be produced by evaporators or compression distillation. For the lower ranges the choice may be hot lime-soda, hot lime-phosphate, hot or cold lime-zeolite. Deionization, though, is available to both. Economic considerations, then, are frequently the deciding factor. Proper selection of the pre-treatment process, as well, can result in reduced operating costs for the boiler makeup water conditioning equipment.

The authors set down the following analysis of the evaporator and the deionization methods.

The evaporator has these advantages: the method is a conventional one, well understood by plant operators and boiler water consultants; operating costs are independent of variations in water analysis and chemical costs; space requirements are small since no chemical storage is needed. On the opposite side of the ledger as disadvantages are: rate of makeup production frequently depends on plant electrical load, the equipment can't be used in advance of plant start-up; with bicarbonate makeup the evaporator vapor carries off CO_2 which requires a deaerator for reduction; periodic cracking and scale removal are needed for best operation unless makeup is pretreated; if ammonia is present it is not properly removed.

Deionization has these advantages: It serves as a source of high quality water for start-up and refilling boiler after scheduled outages; operation is independent of electrical production and can produce high quality water at high rates to satisfy any unusual demands that may develop; makeup quality stays consistently better than with evaporators; equipment can be put in any place in the plant with piping connections few and simple.

In the deionization disadvantage column the authors state: It requires periodic shutdown for regeneration of exchange resins and close attention by the operator during regeneration; you need additional storage space for chemicals.

The authors sum up their story with the expression that the trend seems to be to greater use of deionization. *ESWP Paper. No number.*

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from the following sources unless otherwise stated. Order complete paper from source, not POWER.

Engineers Society of Western Pennsylvania, annual meeting, Wm Penn Hotel, Pittsburgh, Pa, Oct 20-22, 1952, identified by initials ESWP. Obtainable through H M Porter, sec, ESWP, Hotel Wm Penn, Pittsburgh, Pa.

American Society of Mechanical Engineers, Industrial Instrument and Regulator Division, Seventh National Instrument Conference, Cleveland, Ohio, Sept 9-10, 1952. Identified by initials IIRD and ASME. Fall meeting held in conjunction with Centennial of Engineering, Chicago, Ill. Sept 9-10, 1952. Available through ASME, 29 W 39th St, New York 18, N. Y.

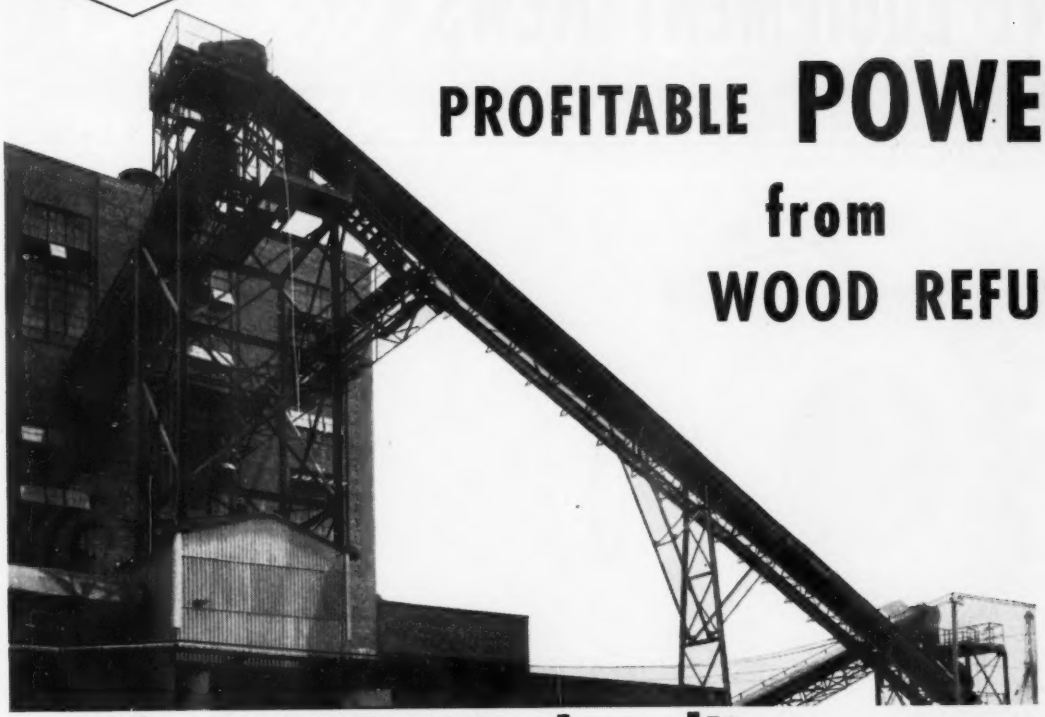
Experiences with Chloride Anion Exchangers for Reducing Alkalinity. *By S B Applebaum, Cochrane Corp.*

You can reduce alkalinity by one of three standard methods: lime with the hot or cold process; sulfuric acid followed by aeration or deaeration; hydrogen zeolite again followed by aeration, deaeration and repumping. But each of these methods carry with them certain distinct drawbacks where smaller plants are concerned. The author, however, describes an answer to these objectives involving use of a relatively new method of alkalinity control by means of the chloride anion.

There are five major advantages as the author sees it: (1) No acid is needed at all. (2) No acid-proof lined shells, piping and valves are required. (3) Salt is employed and is readily available at low cost. (4) Aeration is eliminated for CO_2 removal. (5) Repumping is avoided because chloride

(*Continued on page* 188)

FAIRFIELD SERVING THE NATION'S POWER PLANTS



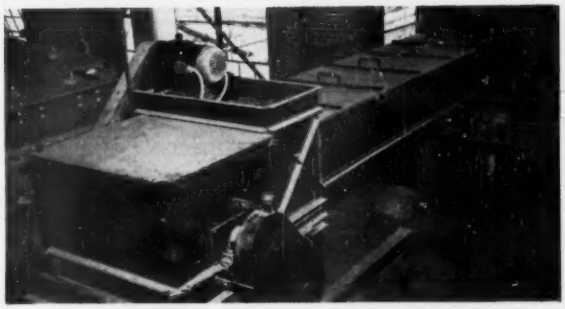
PROFITABLE POWER from WOOD REFUSE

with FAIRFIELD handling systems

Economical power from wood waste has become a reality for many wood products industries who have worked with Fairfield Engineering to develop proper wood refuse handling systems to feed boilers.

Illustrated here are scenes of such an installation profitably at work for a large southern Kraft pulp and paper mill. The Fairfield system consists of a series of belt conveyors which transport bark from the debarking mill, through bark hogs and up to the top of the boiler house where it is stored in a Fairfield "live-bottom" bin. The bottom of the bin contains a series of screw conveyors which properly feed the bark to stokers directly below the bin. Plant officials say that the performance of this Fairfield system has been very satisfactory and has lived up to all expectations.

Investigate this potential power from your wood waste now—an engineering treatise on wood waste systems and a copy of Bulletin 352 is available, write us today.



One of the many enclosed Fairfield Belt Conveyors discharging bark into the "live-bottom" bin atop the boiler house

Screw conveyors built into bottom of the Fairfield "live-bottom" bin feed the bark into the stokers.

FAIRFIELD

The FAIRFIELD ENGINEERING COMPANY

335 Chicago Avenue

MARION, OHIO

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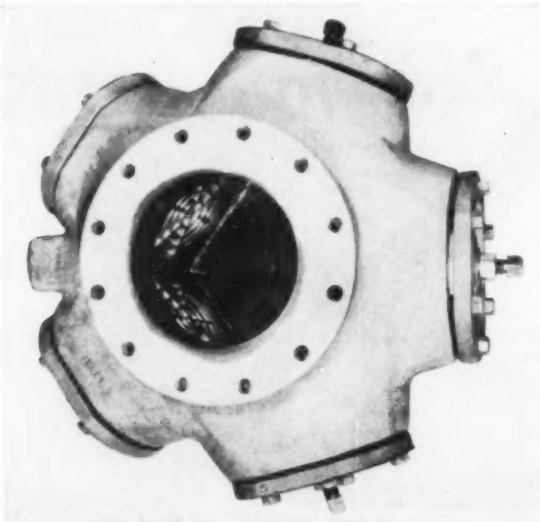
Your information center for new products designed to solve plant problems

Published monthly as a service to readers



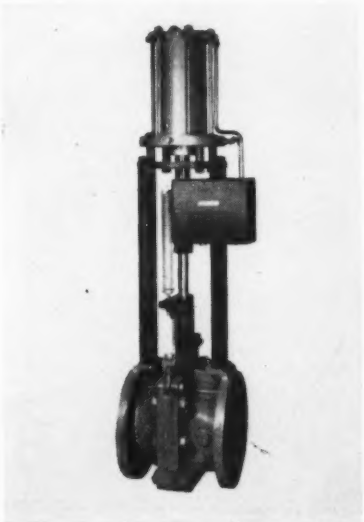
Compressor Discharge Check Valve

132 • *Airchek* valve is identical in design and construction with company's *air cushion* valve used in air compressor cylinders. Only the housing is redesigned. Available in 8-, 10- and 12-in. sizes.

Individual valve bodies may be removed for inspection without disassembling *airchek* from the pipe line; repairs can be made to any unit on a multi-compressor line without shutting down the system.

Unit is self-contained and automatic in operation. It can be installed vertically or horizontally, and dowel pins prevent wrong assembly. Manufacturer claims that this valve will dampen pipe line pulsations.

Pennsylvania Pump and Compressor Co, Easton, Pa.



Cylinder Positioner

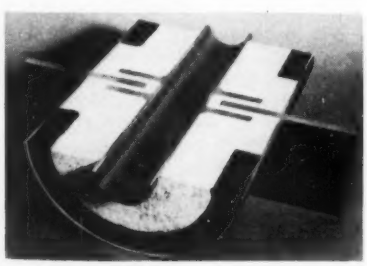
103 • *Poweractor* positioner operates from standard 3-15 psi pneumatic controller signal. It applies a high-pressure, pneumatic differential across cylinder piston, moving it to position demanded by the controller. Unit will position large size control valves, dampers, variable speed drives, etc; can handle up to 150 psig air supply. It positions a piston within 1% of its total stroke under normal loading conditions. Component parts are in weatherproof case.

Foxboro Co, Foxboro, Mass.

Micrometer

107 • Micrometer has new *lustro chrome* finish that is hard and non-peeling, protects the instrument from rust and discoloration, makes graduations stand out against the dull background. Also available are tungsten carbide tipped anvils, said to increase life span 82%.

George Scherr Co, Inc, 200 Lafayette St, New York 12, N. Y.



Insulated Pipe Anchor

144 • Patented anchor eliminates contact between anchor plate and pipe. Thermal and electrical insulation is provided by a non-compressible block of *Transite* sheet material. Design is said to minimize heat loss at anchorage points and prevent pipeline corrosion due to electrolytic action.

Durant Insulated Pipe Co, Warren Way & Bay Rd, Palo Alto, Calif.

Pipeline Flow Monitor

115 • *Max-Alarm* system is designed as safety or warning device for processes or equipment where flow through a pipeline is not to exceed a given value. It can operate a visual or audible warning signal and also shut off a pump or close a motorized valve when maximum limit is exceeded.

Flow sensing unit is unaffected by pressure variations in the measured fluid; can be used up to 20,000 psi and from 4 deg Absolute to 1200 F. System can be used with toxic or highly corrosive liquids, viscous fluids, liquefied gases and other hard-to-handle liquids.

Signal light indicates when switch is on and instrument operating; a second light flashes on only when flow rate has exceeded maximum value.

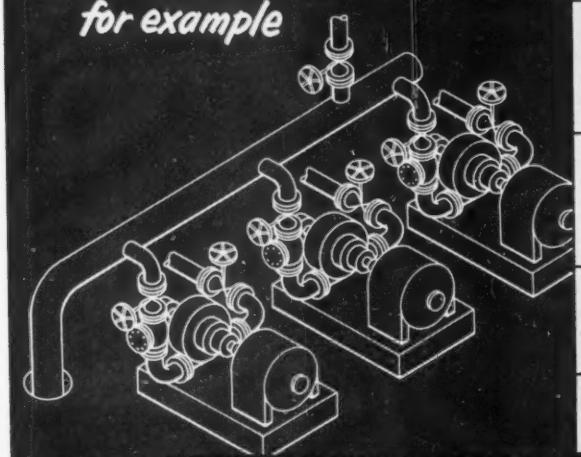
Potter Aeronautical Co, 87 Academy St, Newark, N. J.

(*Continued on page* 156)

For more data on these items, use post cards, p. 163. Identify your request with item number.

Can You Trust Your Checks to Hold Like This?

. . . on Water Pumps, for example



THE INSTALLATION

Crane Iron Body Swing Check Valves in 8-inch vertical lines on discharge side of water pumps supplying a large eastern paper mill.

VALVE SERVICE RATINGS

SUITABILITY:	Working smoothly - no complaints
FEATURES:	O.K. for either horizontal or upward flow
MAINTENANCE COST:	None - no maintenance needed to date
SERVICE LIFE:	Now better than other checks used
OPERATING RESULTS:	No water or head loss
PRICE:	In line with other makes
AVAILABILITY:	Stock item - Crane product

THE HISTORY

The mill depends on these pumps for all water. Loss of head at the pumps would create a serious problem. The mill could take no such risks. Regularly, the check valves on pumps were replaced, but only to be found leaking between pumping cycles, a few months later.

It's now more than a year since the change-over was made to Crane Check Valves. There's been no loss of water, no maintenance or replacement of any checks on the pumps. That was proof enough for the mill, that Crane Quality means better valves —greater dependability and bigger value. As a result, 3 more of these checks were installed on a separate battery of suction pumps.

THE VALVE

Crane No. 373, 125-Pound Iron Body Swing Check Valves, brass trimmed. The long life and high seating efficiency of these checks, in 2 to 8-in. sizes, is in large part due to the Crane patented flexible disc-hinge design. Double spring mounting eliminates lost motion between parts, yet permits true, full contact of disc and seat at every closure. Also serves to absorb the shock of seating under backflow pressure. See your Crane Catalog or Crane Representative for full details.

The Complete Crane Line Meets All Valve Needs. That's Why

More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

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More EQUIPMENT NEWS

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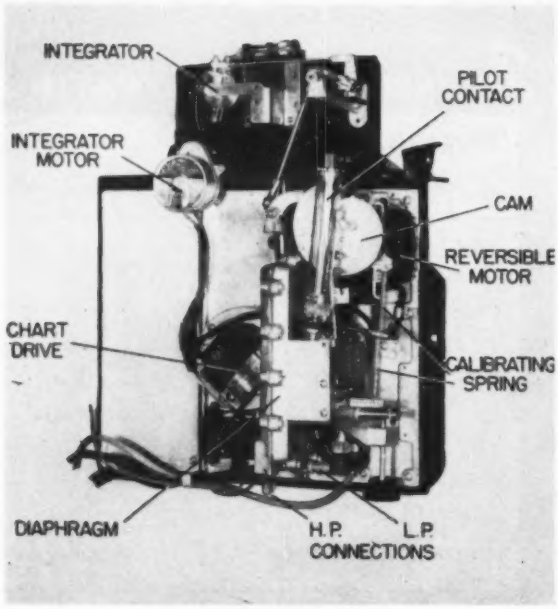
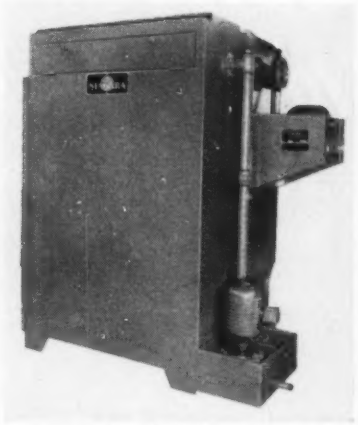


Differential Flow Meter

122 • *Diaflow* meter is designed for measuring air flow, gas flow, or recording the ratio of air flow to gas flow. Unit is adaptable for industrial furnaces and sewage disposal plants. No load is placed on the measuring element, so meter gives high accuracy with negligible friction. Dry diaphragm type measuring element eliminates water, oil, mercury and leveling; unit construction used throughout.

Measuring element is *Hays* differential type diaphragm unit that will accommodate static pressures up to 10 lb and differential pressures up to 20 in. of water. Single heavy-duty fine silver wiping contact converts the diaphragm differential into an electrical impulse that energizes the reversing motor, providing power for the meter.

Hays Corp, Michigan City, Ind.



Air Conditioner

126 • Apparatus dries or moistens atmospheric air by the "liquid contact method." Relative humidity and temperature are fixed independently in this unit. Filtered fresh air enters a spray chamber that either adds or removes moisture by absorption or condensation. Temperature or absorbent concentration of the spray liquid determines moisture content of air leaving the chamber. Temperature is fixed separately, either inside or outside the apparatus.

Spray liquid used for removing moisture may be either refrigerated water or *Hygrol*, a stable organic absorbent liquid automatically held at the proper concentration. Applications include dehumidifying for processing or drying, air conditioning, etc.

Niagara Blower Co, 405 Lexington Ave, New York 17, N. Y.

Electric Convection Heater

123 • *Circle-Air* convection heating system employs a fin-type heating element that does away with all burning surfaces. Five sizes available from 700 to 2800 w, either with or without built-in thermostat. Unit has gray metal cabinet, can be recessed within or placed against wall.

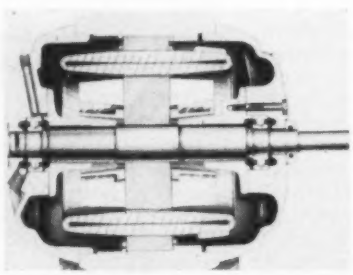
Paley Mfg Co, 244 Herkimer St, Brooklyn 16, N. Y.

Heat Machine

148 • Adjustable vent for permanent installation or portable on-the-job use is featured in 168,000 Btu heat machine. Model VO-168 uses counterflow principle of spraying heat across floor areas in 6-ft thick blanket. Equipped with wheels for portability, unit operates from detached fuel supply, burns Nos. 1 or 2 fuel oil, has 10 gallon optional fuel tank. Dimensions are 21x33x69 in.; weight is 345 lb. Unit has start and stop switch. Bulletin L-5391.

Fageol Heat Machine Co, 5725 Mt. Elliott Ave, Detroit 11, Mich.

For more data on these items, use post cards, p. 163. Identify your request with item number.



Totally-Enclosed Motor

138 • Type SS was designed for service where dampness, dust, fire hazards and corrosive fumes are prevalent. This metal is self-cooling hence has no exterior fan or heat-dissipating fins.

This motor, also available in Type SES, has been approved for explosion-proof service in hazardous locations by the Underwriters' Laboratories, Inc. Motors are available in a range from 1/3- to 2-hp and will later be produced in larger ratings. Bulletin No. 1784.

U S Electrical Motors Inc, Box 2058, Terminal Annex, Los Angeles 54, Calif.

V Packing Rings

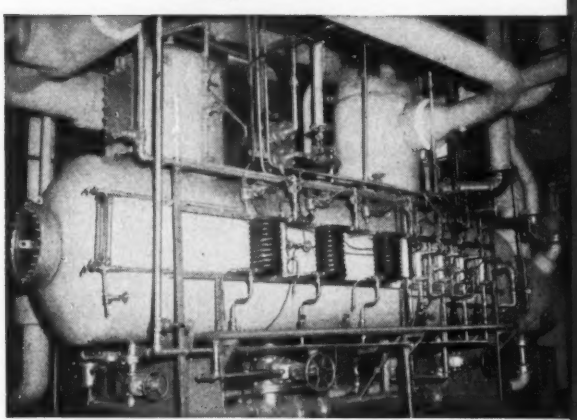
130 • V packing rings molded from *Teflon* are now available in all sizes, in two designs. One is for low pressure and the other for high pressure, up to 5000 psi. Both types can be used against any substance within the range of –90 to +500 F, and are said to give effective seal at low gland pressure and with a minimum of friction. Applications include reciprocating and rotating service on valves, pumps and fittings.

Flexrock Co, Packing Div, 3677 Filbert St, Philadelphia 4, Pa.

(*Continued on page* 158)

Do you need proved power plant equipment?
— let this ALCO check list help you

1 Closed Type Feedwater Heaters
2 Evaporator Condensers
3 Condensate Coolers
4 Jacket Water Coolers
5 Lubricating Oil Coolers
6 Evaporators
7 Oil Tank Suction Heaters
8 Fuel Oil Heaters
9 Blowdown Exchangers
10 Aircooled Heat Exchangers
11 Prefabricated Pipe
12 Propane Storage Tanks
13 Large Diameter Water Lines
14 Penstocks



For Example—ALCO Flex-Tube Evaporators have a positive-acting, thermomechanical descaling action.

Making use of this principle, engineers designed a patented arrangement of struts, tension bars and split support plates. The tubes bend or flex when heat is applied to the coil side. When cold water is sprayed over the tube bundle, the tubes contract, and scale cracks off and is flushed away through blowdown openings.

Other important features include:

HEATING ELEMENT SITUATED IN LOWER HALF OF SHELL, provides maximum disengaging area.

SHELL SIZE GIVES AMPLE SPACE under heating element for scale removal.

SMALL SEPARATE REMOVABLE CHANNEL AND COVER eases job of maintenance men.

TWO OR MORE BLOWDOWN CONNECTIONS of large diameter for effective flushing.

UNIFORM COMPRESSION BOLTING assures tight joints but permits quick convenient access to key points for inspection and maintenance.

For more details about ALCO Flex-Tube Evaporators or your other power plant equipment needs, mail the coupon or call the nearest ALCO sales engineer at Beaumont, Chicago, Dunkirk, Houston, Kansas City, Los Angeles, New York or Tulsa.

ALCO

ALCO PRODUCTS DIVISION
AMERICAN LOCOMOTIVE COMPANY
Dunkirk, N. Y.

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ALCO PRODUCTS DIVISION
American Locomotive Company
Schenectady, New York

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Please send me the ALCO Products Catalog AL-3-T. We are interested in ..... equipment.

Name_____ Position_____

Company_____

Address_____

City_____ Zone_____ State_____

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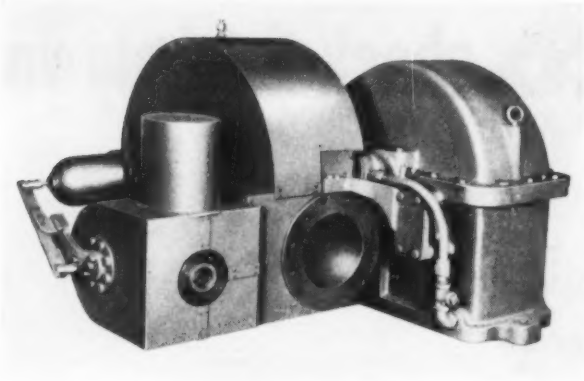
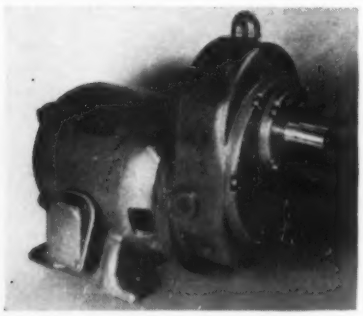


High-Speed Reduction Gears

150 • New line of high-speed reduction gears for mechanical-drive turbines are available in built-in or coupled designs. Built-in gears include Elliott turbine and gear case firmly secured together, with turbine wheels and pinion mounted on same shaft. This eliminates exhaust-end bearing and coupling, permitting a compact unit. Coupled design is a self-contained gear unit flexibly coupled to a separate turbine drive. Both designs feature hobbed double helical gears, liner-type sleeve bearings, special Kingsbury-type shaft seals, and self-contained forced-feed lubrication system. Gears are offered in ratios up to 5:1 for built-in units, to 8.5:1 for the coupled design.
Elliott Co, Advertising Dept, Jeannette, Pennsylvania



Single-Reduction Gearmotor

141 • This gearmotor meets the mounting limitation requirements peculiar to side entry agitators and mixers, and is suitable for light duty coupled service applications such as fans and pumps. It is available in ratings from 1 to 30 hp, 780 to 420 rpm, AGMA Classes I and II.
Westinghouse Electric Corp, P O Box 2099, Pittsburgh 30, Pa.

Wick Feed Oiler

149 • Brass bodied, small capacity *Wick Feed* oilers are simple, sturdy, dust proof. They feed filtered oil; dirt cannot reach bearings. Oilers are especially suitable for dusty surroundings on all classes of machinery. Bulletin 41-11.
Oil-Rite Corp, 2378 Waldo Blvd, Manitowoc, Wis.

Air Velocity Meter

131 • Air-velocity meter gives instantaneous, direct readings, with accuracy claimed to be better than 1½%, and response time less than one second. Specially designed for air pollution studies, smog research, weather stations, etc. Meter has two basic units—the probe or measuring element and the meter or indicating unit. Indicating unit may be remotely located if desired. Dual-range scale reads from 0 to 400 fpm and from 400 to 6000 fpm. One unit can be used with additional probes to check velocities at as many as 25 points.
Hastings Instrument Co, Hampton 10, Virginia

Helmet Liner

101 • Winter liner for safety helmets is made of soft, close-woven wool, fits over head, neck and ears and ties under the chin. It does not attach to the helmet. Three sizes, small, medium and large.
Industrial Products Co, 2923 N Fourth St, Philadelphia 33, Pa.

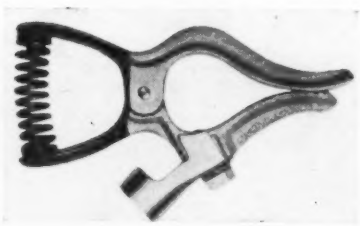
For more data on these items, use post cards, p. 163. Identify your request with item number.

Air-Dry Lubricant

151 • *Lubond* may be sprayed or brushed on, has good lubrication characteristics at temperatures from –70 to 300 F. It may be applied to steel, iron, stainless steel, lead foil, aluminum, brass, wood, cork, etc, and is resistant to hydraulic fluids, gasoline, lubricating oils, water, etc.

Before applying *Lubond*, the surface should be free of grease. Conditioning the surface by phosphate coating, anodizing, or sand blasting gives improved results.

Lubricant is recommended for hinge pins, hydraulic cylinders, gears, threads, water valves, tracks, springs, floats, bolts and nuts, actuator screws, etc.
Electrofilm Corp, 7116 Laurel Canyon Blvd, N Hollywood, Calif.



Arc Welding Ground Clamp

111 • Model GC-200 *Cub* ground clamp has rated capacity of 200 amp. Unit features protruding upper lip for extra leverage, wide jaws for extra conductivity, serrated lower jaw to remove rust and scale and assure a clean connection. Ground connection can be shifted easily and quickly to reduce "arc blow."
Tweco Products Co, Box 666, Wichita, Kan.

Stand-By Electric Plant

143 • A 10 kw unit suited for hospitals, theaters, commercial buildings, industrial plants, construction projects, etc. It is available with electric starting or can be supplied with controls which automatically start the plant when regular power fails.

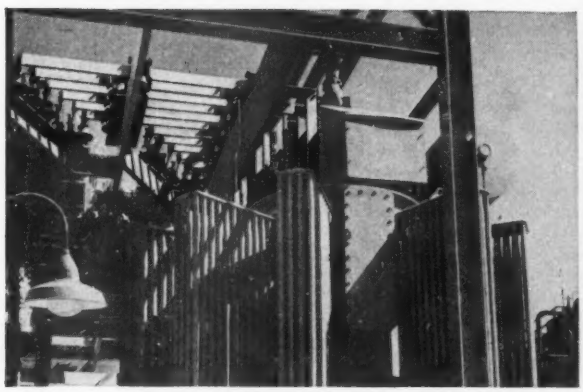
Unit features a four-cylinder air-cooled gasoline engine. Not having a water cooling system to require attention, the plant's maintenance needs are reduced to a minimum. Bulletin DHE-1.
Universal Motor Co, 494 Universal Drive, Oshkosh, Wis.

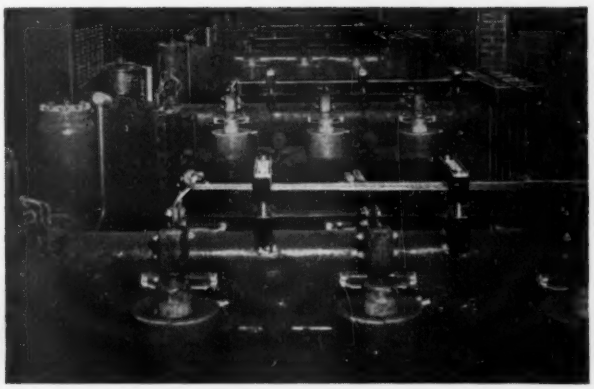
Variable Speed Drive

140 • Electronic variable speed drive for control of fractional hp motors. Packaged drive consisting of an electronic, adjustable speed control unit driving a series motor. It provides a wide, stepless range of speed control with good speed regulation under varying loads. With the optional dual-range feature, speeds from 100 to 3500 rpm are available.
Motor Control Division, The Arrow-Hart & Hegeman Electric Co, 103 Hawthorn St, Hartford 6, Conn.

(*Continued on page* 160)

It takes a Lot of Copper to make a Lot of Chemicals!





These photographs show a lot of copper bus bar in a new plant of a great chemical company, whose name and location cannot be disclosed. The copper carries heavy currents to electro-chemical equipment for the production of valuable products used in national defense and in industry. Revere furnished 325,000 pounds of bus bar for this service, the bar going into substations, rectifier stations, and cell houses. In addition, at the time of installation the Revere Technical Advisory Service collaborated with the customer in working out some difficult details in the design of switches. If you need electrical conductors, remember that copper has the highest electrical conductivity of all the commercial metals, that Revere makes bus bar, and that the Revere Technical Advisory Service is always ready to work with you on any problem concerning copper and its alloys or aluminum alloys. Call the nearest Revere Sales Office.

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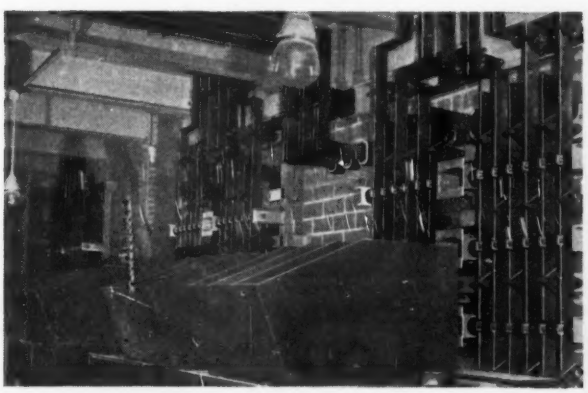

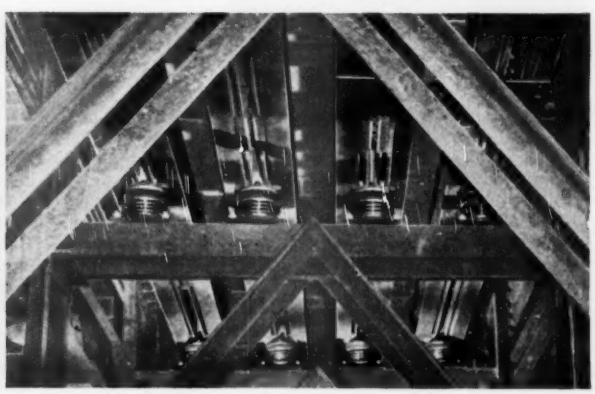

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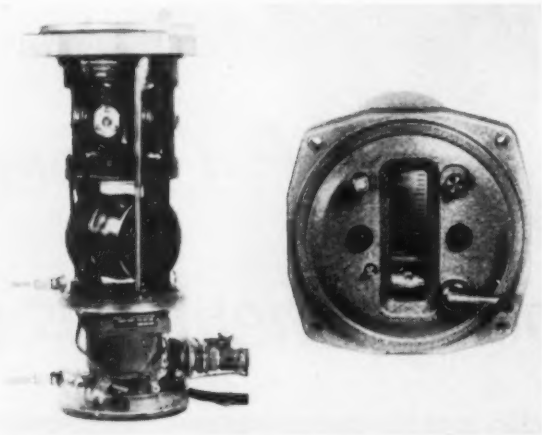


Precision Pressure Meter

139 • The *Press-I-Cell* instrument can measure pressure with an accuracy of one part in 5000, and has a sensitivity of one part in 15,000. Meter measures 5-in. by 14-in., is portable, temperature-stable, and unaffected by vibration or mounting position. The 600-in. scale was developed to take full advantage of the accuracy of instrument's pressure-sensing elements and their follow-up mechanism. The scale, printed on a 35 mm film strip, is virtually unaffected by temperature or humidity changes, since the reading portion of the scale is held to constant length by pair of winding sprockets spaced 2 in. apart.

Press-I-Cell is not intended to replace the standard instruments used in the usual type of pressure-measuring applications where extreme accuracy is not required. Rather, the designers suggest the following types of applications: a master laboratory instrument for calibrating other pressure-sensing instruments; precision measurement of altitude or barometric pressure; a liquid level gage for large storage tanks; field tests requiring high preci ion or sensitivity with a compact test gage.

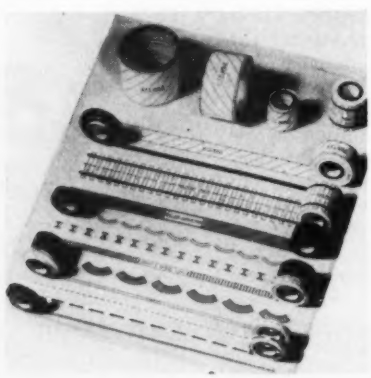
Fischer & Porter Co, Hatboro, Pa.

Dustless Masonry Cutter

108 • Model DW *Eveready Briksaw* is designed for dustless (wet) cutting or for dry cutting where dust is not objectionable. High-capacity centrifugal water pump sweeps away dust and material particles in a constant water spray, but pump need not be unhooked when cutting dry. Snap-lock hinged blade guard protects operator from both blade and water spray.

Eveready Briksaw Co, Dept 277, 1509 S Michigan Blvd, Chicago 5, Ill.

For more data on these items, use post cards p 163. Identify your request with item number.



Plant Layout Tape

147 . Pre-printed *Labelon* adhesive tape eliminates tedious initial drawing of repetitive symbols, allows instant changes in temporary layouts. Tape is pressure-sensitive, can be stripped off repeatedly without leaving a mark or losing adhesive quality.

Standard symbols for walls, aisles, conveyors, monorails, centerlines, columns, shafts, stairways, service lines, railroad tracks, etc are available in either 324 or 648-in. rolls, scale ¼ in. to the foot, in opaque or transparent types.

Labelon Tape Co Inc, 450 Atlantic Ave, Rochester 9, N. Y.

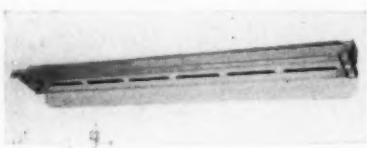
CHECK THESE TOO! . . .

Gage Illuminator . . . . . p 168
Electric Hammer Drill . . . . . p 170
Mono-Column Demineralizer . . . . p 174
Sand Blaster . . . . . p 176
Screw Feed Coal Handling . . . . . p 178
Insulating Putty . . . . . p 180
Ball Valve . . . . . p 184
Electronic Crane Scale . . . . . p 186

Automatic Cut-Off Valve

152 • New type automatic gas cut-off valve is designed with fusible Geon 404 plastic link that, in case of fire, will melt at about 165 F, forcing tension spring to close valve. Called the *Kelly-Byrne* positive safety valve, it is intended for placement on building's gas supply line in front of the gas meter. Valve has ground metal-to-metal seating. Replacement links return valve to operating condition after fire.

M W Osborne, Jr, B F Goodrich Chemical Co, 324 Rose Bldg, Cleveland 15, Ohio



Lighting Fixture

142 • An industrial luminaire, type SDP, which provides an upward component of light; it uses two slimline lamps of 38, 58, or 75 watts each. Upward component, distributes 23% of the light towards ceiling, eliminates severe contrast between bright luminaires and dark ceiling.

Styled for heavy industrial use, the luminaire provides the upward component by slots located over the lamps on each side of the reflector. The all-white hood is heavily ribbed and consequently has lost none of its strength due to the introduction of the slots. The porcelain enamel reflecting surface is one piece and is easily removable for cleaning. It uses the new lead-lag slimline ballast.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Fuel Oil Conditioner

118 • Hydrogen-fortified compound said to replace hydrogen atoms stripped from petroleum molecules by catalytic processes. Manufacturer claims that *Oilate* increases thermal efficiency of the fuel, also breaks up the heavier fuel fractions that usually settle to the bottom of the tank as sludge. It can absorb up to 40% of its own volume of water, protecting tank against condensation and rusting within. Recommended for all grades of burning oils.

American Additive Co, 7301 W Lake St, Minneapolis 16, Minn.

(*Continued on page* 168)

IN 820 N.J.

ANCHOR COMBINED PURE ASBESTOS GRAPHITE BUNA N

TO GIVE YOU A PACKING FOR A THOUSAND USES!

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DAYTON, OHIO SAN FRANCISCO, CAL.
DETROIT, MICH. SEATTLE, WASH.
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This packing—CARBONITE #820 N. J.—has the greatest range of uses of any packing known: Steam and Air . . . Chemicals . . . Acids . . . Solvents . . . Water . . . Oil . . . Gasoline.

It is 100% pure asbestos, graphite and Buna N. Perfectly formed rings of any diameter are easily cut from the spirals. No die-forming is required.

"N. J." means "No Jacket." This superior packing is supplied in spiral or ring form in sizes from 3/16" square up to 1" square.

Write us today for further details on this packing-of-a-thousand-uses.

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FIBROUS AND METALLIC PACKINGS FOR EVERY INDUSTRIAL PURPOSE

ILLCO-WAY ionXchange

serving the essential power plants of American industry

pioneers and leaders in ionXchange

ILLCO-WAY "firsts" include manufacture of the first commercial two-bed De-ionizer . . . the first commercial mixed-bed De-ionizer . . . and the development and building of the first successful installations for the purification of such liquids as beet-juice and crude glycerol by ionXchange . . . In the power field, boiler feed water treatment by ILLCO-WAY ionXchange has long meant lower operating costs and increased operating efficiency. Installations in leading plants.

ILLCO-WAY

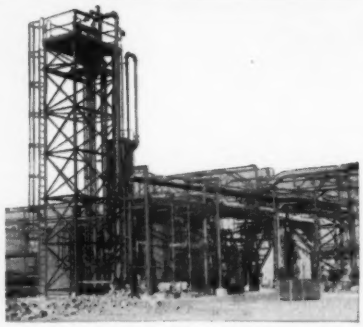
DE-IONIZING
DE-ALKALIZING
SOFTENING

For complete data, see Sweet's File, Power Plant

ILLINOIS WATER TREATMENT CO., 853-1 Cedar St., Rockford, Illinois
141 East 44th Street, New York 17, N.Y.
Canadian Distributor: Aurora & Safeness Ltd., London, Ontario

(Advertisement)

CASE HISTORY



DOW CHEMICAL CO.

Power Plant of the Dow Chemical Co., Texas Division, Freeport, Tex., uses Illco-Way De-ionizing equipment (*above*) to treat 600 gpm of boiler-feed make-up water. Dissolved solids, silica, and CO_2 are removed by ionXchange.

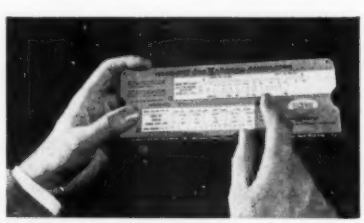
The power plant operates seven Riley boilers, each at 250,000 lb. per hr., at 400 lb. 750°. These gas and oil fired steam generating units serve six turbo generators.

According to the plant's chief engineer, the most significant advantage resulting from

Illco-Way equipment, used in America's outstanding plants, includes the recently-developed Mixed-Bed De-ionizers, Hydrogen-Zeolite Units, Zeolite Softeners, Degasifiers, Filters.

the installation of this Illco-Way De-ionizing unit was the improvement of steam quality . . . "which has resulted in a marked increase in the duration of satisfactory operation of the turbine units between washing periods."

Equipment has enabled the plant to reduce phosphate additions by approximately 60%, further assisting in the reduction of the total solids within the boiler while still maintaining a proper phosphate ratio.

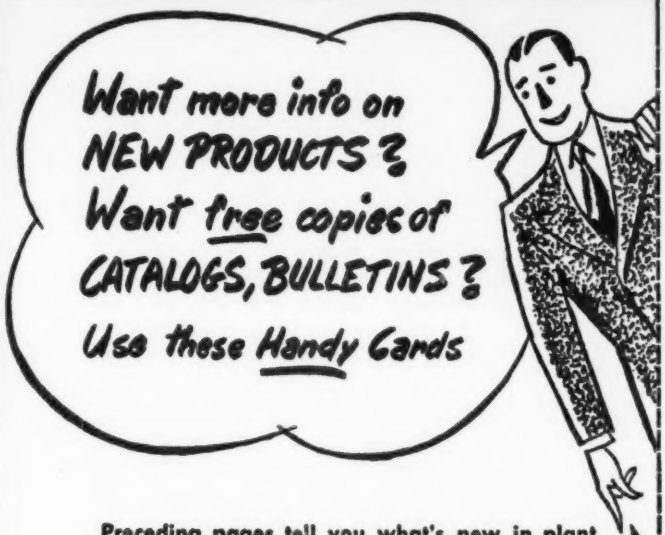


QUICK CALCULATOR

A handy ionXchange calculator for conversion of water analysis has been developed by Illco-Way. The easily-read sliding scale is used to convert ppm to gpg or gpg to ppm. Also ppm or gpg to gpg as $CaCO_3$. This accurate pocket-piece is helpful to anyone operating water treatment equipment or to engineers specifying such equipment. Request for one of these Calculators should be sent to Illinois Water Treatment Co., Rockford, Illinois, on your company letterhead.

NEW MIXED-BED DE-IONIZERS

Installed in many power plants, Illco-Way Mixed-Bed De-ionizers are producing feed water of extreme purity. Units provide an effluent of constant quality with a near neutral pH.



Preceding pages tell you what's new in plant equipment. Each item is numbered. For more info on any of them, write in their numbers here

New free catalogs and bulletins are listed beginning on back of this page. To order those you want, write in their item numbers here

Put 2¢ stamp on self-addressed card and mail it to us. We'll pass along your requests to the various companies, they'll send the info

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USE THESE CARDS

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- **Be sure to write in number of page on which item appeared, and issue of POWER in which you spotted it**
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Describe item here

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Title.....

Company.....

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City, State.....

This month's FREE Literature

AIR CONDITIONING, HEATING REFRIGERATION AND VENTILATION

1 **HUMIDITY FACTS**—Booklet entitled *A Few Facts About Humidification* gives definition, pointers for Yarn, Tobacco, Leather, Paper and Printing industries. 12 pages, tables. Abbeon Supply Co, 179-15 Jamaica Ave, Jamaica 32, N. Y.

2 **DRIERS**—4-page catalog of straight-through refill and non-refill driers. Complete size, weight, capacity and price data. Bulletin 700. Henry Valve Co, 3215 North Ave, Melrose Park, Ill.

3 **ELECTRONIC AIR CLEANERS** — History and principle of method, features and specifications of all models. 12 pages, illustrated, suggested specifications. Trion, Inc, McKees Rocks, Pa.

4 **INDUSTRIAL FANS** — Illustrated 12-page booklet gives features, wheel types, hookup arrangements, accessories, performance tables. Booklet SA-6873. Westinghouse Sturdevant Div, Dept T-415, 200 Readville St, Hyde Park, Boston 36, Mass.

5 **UNIT HEATERS**—Describes expanded line of gas-fired unit heaters. Gives dimensions, capacities. 4 pages, illustrated. Bulletin 23-2. United States Air Conditioning Corp, 33rd & Como Ave SE, Minneapolis 14, Minn.

6 **DAMPERS AND DAMPER OPERATION**—12-page Catalog 8502 describes louver, round, mixing outlet, outlet and fire dampers; electric, pneumatic and manual damper operators. Includes velocity-pressure drop charts, application data, ratings. Minneapolis-Honeywell Regulator Co. Brown Instruments Div, Sta 213, Wayne & Windrim Aves, Philadelphia 44, Pa.

BOILERS AND AUXILIARIES

7 **STEEL BOILERS**—Improved boiler line with specifications, dimensional data. 4 pages, drawings, photographs. Catalog JR-10-1. Fitzgibbons Boiler Co, Inc, 101 Park Ave, New York 17, N. Y.

8 **CYCLONE FURNACES**—Hardening, annealing, normalizing, tempering, nitriding and special heating functions described. 8 pages, illustrated. Bulletin 131. Lindberg Engrg Co, 2450 W Hubbard St, Chicago 12, Ill.

9 **GAS AIR INSPIRATORS**—6-page catalog 306A gives capacities, dimensions of Venturi mixer design for constant air-gas ratio. Illustrated. Hauck Mfg Co, 124-136 Tenth St, Brooklyn 15, N. Y.

10 **OIL BOOSTER**—Closed heating system uses high flash-point oil for heat transfer, to 600 F. 4 pages, illustrated. Bulletin AD-108. Cleaver-Brooks Co, 326 E Keefe Ave, Milwaukee 12, Wis.

11 **BOX MUFFLE FURNACES** — Laboratory furnaces for high and low temperature testing. Bulletin 215, 4 pages, illustrated. Burrell Corp, 2223 Fifth Ave, Pittsburgh 19, Pa.

COMPRESSORS AND ACCESSORIES

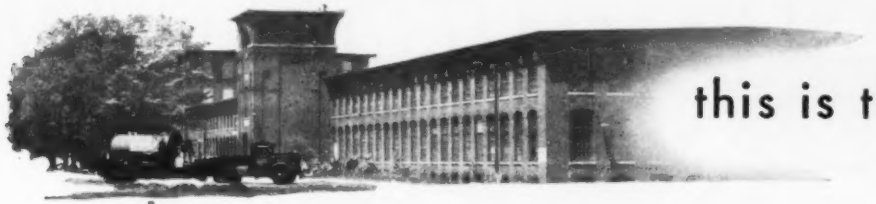
12 **CENTRIFUGAL COMPRESSORS** — Single stage compressors from 30 to 600 hp, pressures 1¼ to 3½ lb. Gives applications, ratings, design features. Bulletin 109, 12 pages, illustrated. American Blower Corp, Detroit 32, Mich.

13 **AIR CYLINDERS**—16-page booklet has charts, photographs on capacity, mounting type, etc, description of features. Bulletin 721. Lindberg Engrg Co, 2443 W Hubbard St, Chicago 12, Ill.

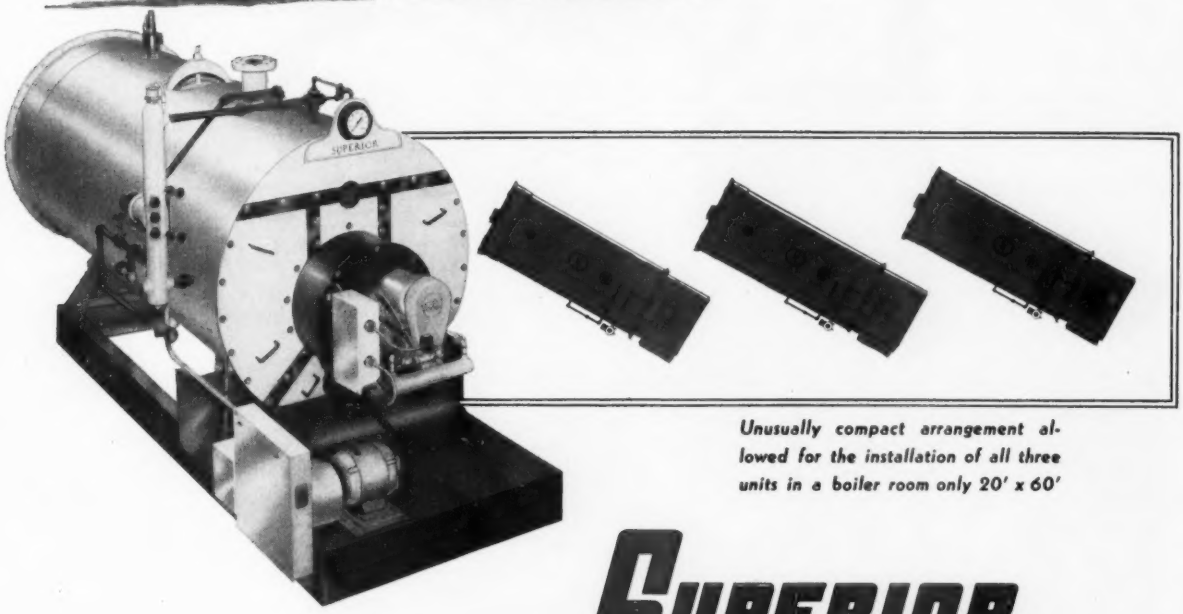
ELECTRICAL EQUIPMENT

14 **NEW AND USED EQUIPMENT**—Displays stock of motors, transformers, circuit breakers, gas diesel sets, motor generators. Bulletin 51B, 36 pages, illustrated. Electric Equipment Co, 63 Curlew St, P O Box 51, Rochester 1, N. Y.

(Continued on page 220)



this is the plant . . .



Unusually compact arrangement allowed for the installation of all three units in a boiler room only 20′ x 60′

. . . . where 3 SUPERIOR STEAM GENERATORS saved more than their cost in less than 2 years

Only four years ago, this plant was inadequately heated with coal at a fuel cost (excluding labor) of approximately $44,000. per year. Three years ago, three Superior Steam Generators were installed with the following three results:

(1) Fuel costs were cut to $22,000 . . . and in less than two years, those Superior Steam Generators saved their total cost.

(2) The ability of those Superior Steam Generators to deliver their full rated capacities provided steam in excess of that required for heating . . . which was sold as process steam to further reduce the cost of operation.

(3) Because of their compact design, a substantial saving in space resulted; and the space thus saved was profitably rented to still further reduce the cost of operation.

To meet increased demands for process steam, a fourth Superior Steam Generator has recently been installed.

This is but one of the many case studies which demonstrate the advisability of investigating the installation of Superior Steam Generators in your plant. For complete details write for Catalog 501.

Superior Steam Generators are fully automatic; burn oil, gas, or both. 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i. or for hot water.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR STEAM GENERATORS

The Alchemist

ENGINEERS VISITING the chemistry building of the University of Pennsylvania stop dead in their tracks on seeing this bas relief of the "Alchemist." Created by sculptor Donald De Lee, this work is highly symbolic of chemistry's dubious beginning.

The ancient alchemist tried without success to change base metals into gold, platinum, silver and other so-called "noble" metals. But where the alchemist failed, I figure that the modern metallurgist has succeeded.

Metallurgists have not only produced a metal alloy with noble properties, but at a cost far below those of the traditional noble metals. I'm talking about the familiar high-nickel-chromium steels, created by alloying iron with high percentages of nickel and chromium. Every power engineer knows how vital these metals are to our modern civilization, especially in the power plant.

My point is that many of our highly efficient tools and materials for turning out today's power at greatly lower rates had beginnings about as discouraging as the alchemists' experiments. But like the alchemist, there always were men who didn't know when they were licked.

All this proves that so long as you work toward improvement, you have a good chance of succeeding—if you stick to it.

George Edwards

Engineer

"Alchemist" Sculpture by Donald De Lee, Courtesy National Sculpture Society

ARE CLOGGED LINES LIKE THESE CUTTING YOUR WATER SUPPLY?

Over 1½ Miles of Buried Water Line Chemically Cleaned IN PLACE by Dowell Service

You don't have to dig up water lines in order to clean them! Take the case of a major railroad that had over 8600 feet of *buried* water lines, ranging from 2 to 12 inches in diameter. The capacity of these lines had been greatly reduced by scale deposits. Dowell Service used liquid solvents to clean all the lines, *in place*, during a period of only six days with a minimum interruption in service.

Dowell Service offers *fast*, effective chemical cleaning of pipelines of all kinds—water lines, disposal lines and product lines. And, whether these lines are underground or above, indoors or out, no digging or dismantling is necessary. Dowell solvents are designed to dissolve the accumulated deposits, and are introduced through regular connections. Because they are liquid, Dowell solvents reach wherever steam or water can flow, cleaning places inaccessible by other methods—angles, curves, valves, complicated surfaces and hook-ups. *Experienced* Dowell engineers do the job using Dowell-designed truck-mounted pumps, mixers and control equipment.

Many other types of equipment can also be cleaned chemically by Dowell. If you have boilers, condensers, evaporators, bubble towers, water wells or other operating equipment where deposits are reducing capacity, let Dowell Service *save you time and money in maintenance cleaning!*

FIND OUT ABOUT CHEMICAL CLEANING! There are many places in your plant where Dowell Service can clean equipment faster and better than out-dated mechanical methods. Call your nearest Dowell office for a fact-filled book. Or write direct to Tulsa, Dept. A23.

DOWELL SERVICE

Over 100 Offices to Serve You with Chemical Cleaning for:

Boilers • Condensers • Heat Exchangers • Cooling Systems
Pipe Lines • Piping Systems • Gas Washers • Process Towers
Process Equipment • Evaporators • Filter Beds • Tanks

Chemical Services for Oil, Gas and Water Wells

DOWELL INCORPORATED
Tulsa 1, Oklahoma

Look to
DOWELL
FOR OIL INDUSTRY CHEMICAL SERVICE

PROMPT
ROTOJET TUBE CLEANER
SERVICE
Prevents costly delays

It is a tribute to the durability of ROTOJET Tube Cleaners that so many of them outlive the equipment for which they were bought. Why wait until your tube cleaners wear beyond repair when an inexpensive adjustment or parts replacement can put them into first class condition again?

Do This Now—

Examine your motors, hose, and couplings, and check your stock of heads and brushes. Let our trained mechanics make any necessary adjustments. Do it now, and they'll be ready when you need them.

For Prompt Service and Delivery
YOUR BEST BET IS
ROTOJET®

ELLIOTT COMPANY-ROTO DIVISION
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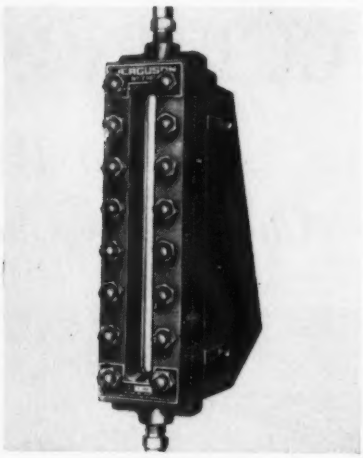
More EQUIPMENT NEWS

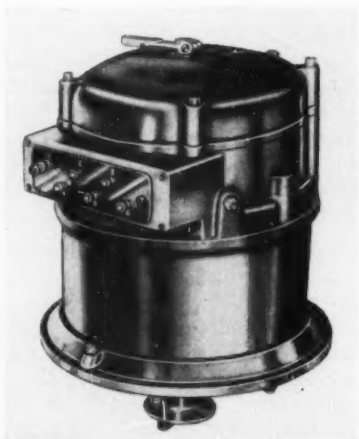
Begins on page 154



Gage Illuminator

104 • Mercury vapor illuminator permits gage readings over longer distances or under poor lighting conditions. Water column shows blue-green, topped with brilliant emerald green spot at water level. Weatherproof illuminator clips to gage cover with no alterations to gage. Sizes fit standard gages. Catalog available.
Jerguson Gage & Valve Co, 80 Fellsway, Somerville 45, Mass.

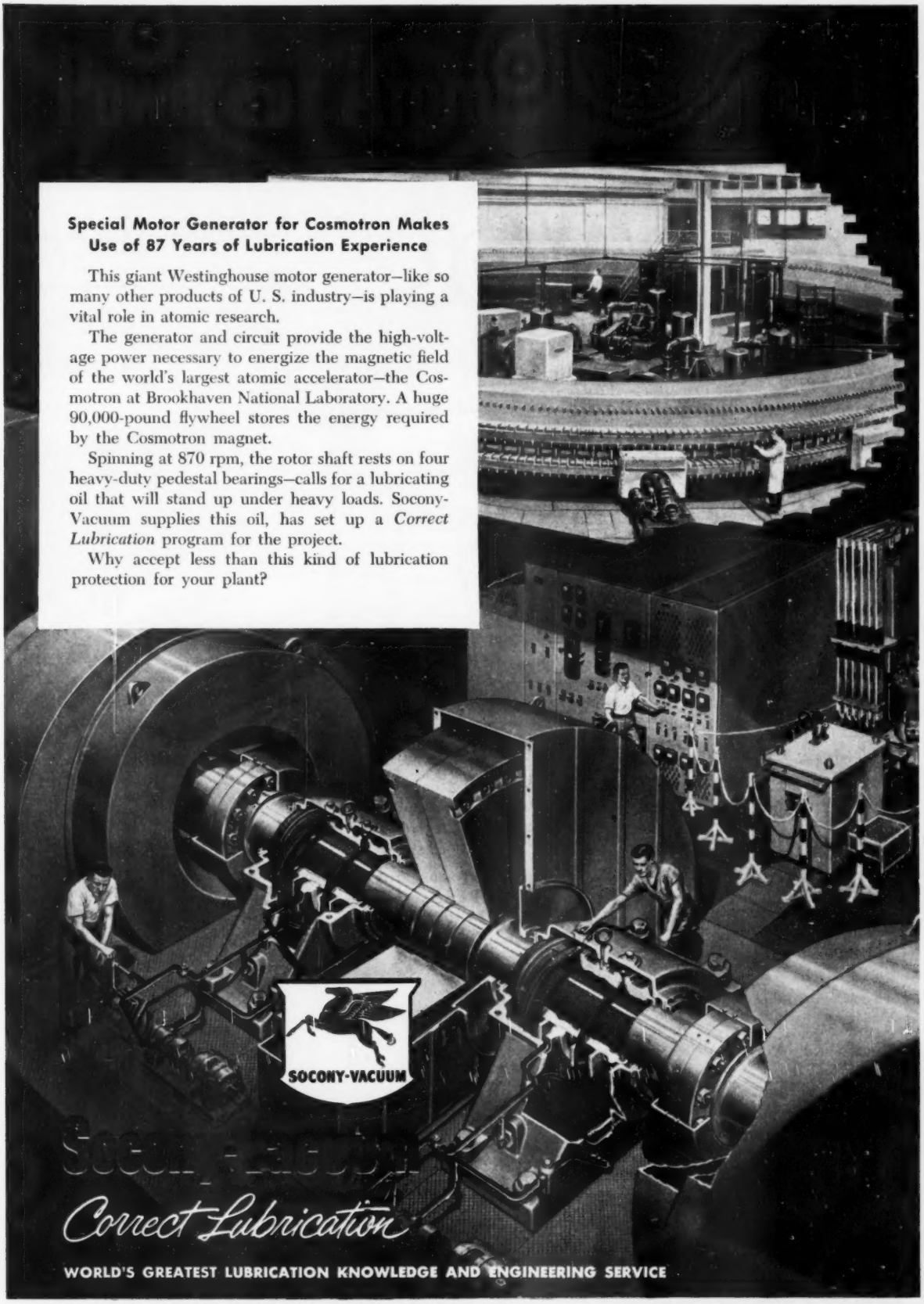
For more data on these items, use post cards p 163. Identify your request with item number.



Long-Lived Ignition System

125 • New long-lived ignition system is based on a pulse generator. It can produce output potentials up to 30,000-v with extreme reliability, and will let internal-combustion engines run 6 months without shutdown, even for spark-plug inspection, according to the manufacturer.

Pulse generator *MGC* is approximately 11¾ in. in diameter, stands about 12½ in. above its mounting. It supplies accurately timed low tension electrical pulses that are stepped up to the required spark potential by either single or double ignition



Special Motor Generator for Cosmotron Makes Use of 87 Years of Lubrication Experience

This giant Westinghouse motor generator—like so many other products of U. S. industry—is playing a vital role in atomic research.

The generator and circuit provide the high-voltage power necessary to energize the magnetic field of the world's largest atomic accelerator—the Cosmotron at Brookhaven National Laboratory. A huge 90,000-pound flywheel stores the energy required by the Cosmotron magnet.

Spinning at 870 rpm, the rotor shaft rests on four heavy-duty pedestal bearings—calls for a lubricating oil that will stand up under heavy loads. Socony-Vacuum supplies this oil, has set up a *Correct Lubrication* program for the project.

Why accept less than this kind of lubrication protection for your plant?

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

When You Think of

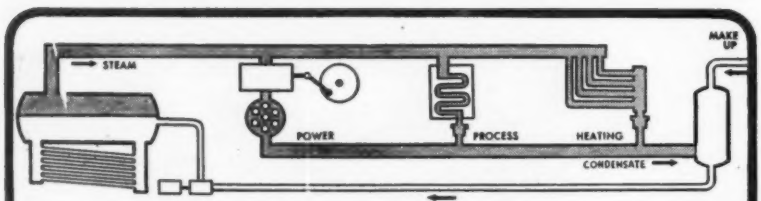
CORROSION PROTECTION for your STEAM SYSTEM

Think of

CORAVOL

(The Original* AMINE PROCESS)

Because CORAVOL Circulates to Control Corrosion



The CORAVOL ZONE—indicated by the shaded area in the diagram—includes every part of a steam system not accessible to boiler feed water treatment. It includes the boiler above the water line, steam lines, condensate return lines, radiators, valves, traps and equipment. This zone can now be reached and protected against rust and corrosive action—by CORAVOL.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special chemical formulas for . . . boiler feed water . . . foam prevention . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply . . . soot removal.

CORAVOL circulating throughout your steam system protects it from corrosive attack. **CORAVOL** saves costly pipe repairs and replacements—maintenance labor—hours and days of shutdown loss. **CORAVOL** cleans out clogging rust deposits, improving heat transfer, restoring original capacity of lines and efficiency of valves and traps.

CORAVOL, the original* amine process, has the flexibility that lets it conform to each individual need. The **CORAVOL** you will use is formulated to do the best protective job under your own plant conditions.

*The use of **CORAVOL** in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

Chemical Water Treatment

WESTERN CHEMICAL COMPANY

713 Washington Street
Kansas City 6, Missouri

MAIL COUPON TODAY for
Complete Data about the CORAVOL Process

Western Chemical Company,
713 Washington Street,
Kansas City 6, Missouri

Send me full information about CORAVOL.

NAME_____

FIRM_____

ADDRESS_____

CITY_____ ZONE_____

STATE_____

More EQUIPMENT NEWS

Begins on page 154

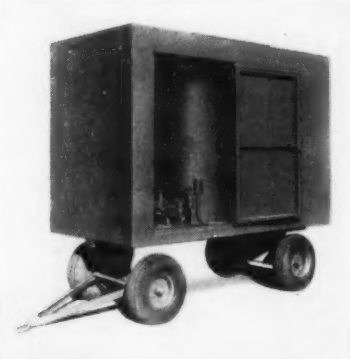
transformers mounted on each cylinder near the spark plug or plugs.

No breakers are in operation during running and no distributor is used. Breakers are used for starting only and are automatically retracted mechanically during normal operation. At operating speeds the rotor and two ball bearings are the only moving parts.

Once set, the timing is permanent, and operation is entirely independent of breakers, contacts, switches, etc.

American Bosch Corp, Springfield, Mass.

For more data on these items, use post cards p. 163. Identify your request with item number.

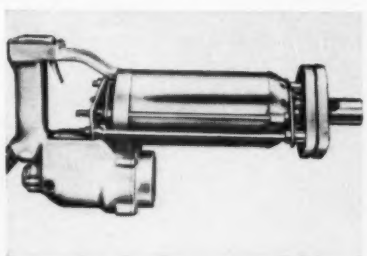


Insulating Oil Purifier

135 • Mobile insulating oil purification system for field use. Complete system is housed in an all-metal trailer equipped with hitching device and four pneumatic tires. Can be easily transported to transformers, circuit breakers and other electrically operated oil-filled equipment. System includes a portable insulating oil purifier, pump and motor, 7½-kva transformer, line strainer, by-pass valve, pole switch, integral piping, wiring and controls.

Unit measures about 4 ft wide by 8 ft long by 6 ft high. It will operate at capacities up to 300 gph.

Honan-Crane Corp, Lebanon, Ind.



Electric Hammer Drill

127 • Model 26-RO combines the power of a large electromagnet hammer with automatic rotation of a spiral fluted, carbide-tipped drill bit. Automatic rotation is accomplished by a similar rubber ratchet mechanism that uses the recoil of each

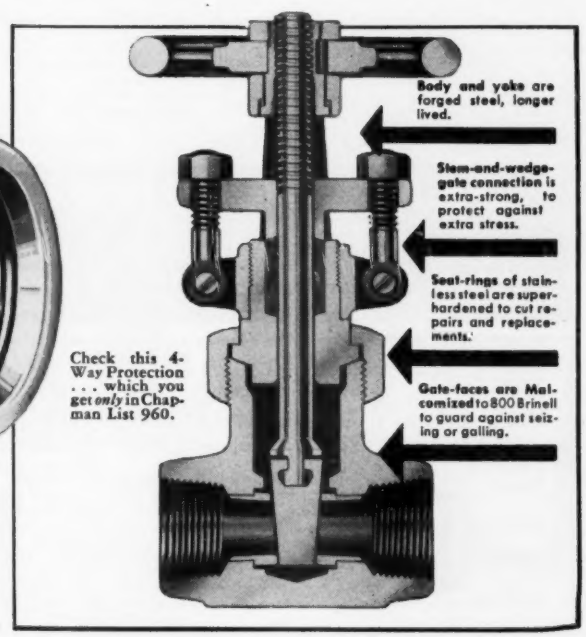
Name Your Job!

If it's for Small Forged Steel Gate Valves . . . then it's for

CHAPMAN LIST 960

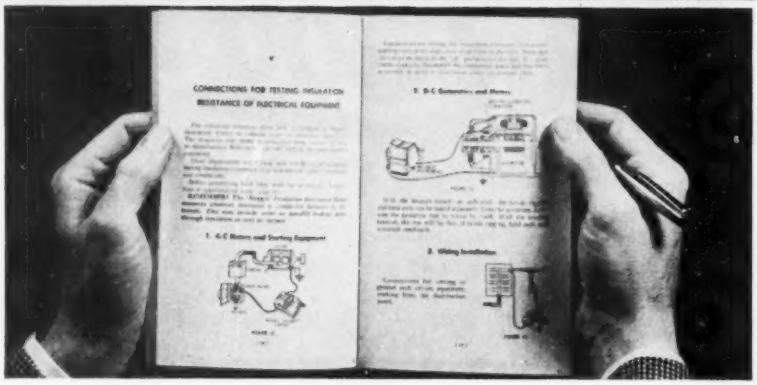
Many different jobs . . . but on each one, List 960 gives you the same top standard of Chapman Valve performance. Check the 4 exclusive Chapman features below . . . and make this your *check list* in buying *all* forged steel gate valves from ½" to 2" inclusive.

Chapman List 960 is manufactured with rising stem, either with yoke as shown, or with inside screw . . . and with gasketed or metal-to-metal bonnet joints. Pressure range: 2,000 lb. at 100°F. to 380 lbs. at 1,000°F. For higher pressures, specify List 990. Have you a copy of Catalog No. 10? Write for it today.


Body and yoke are forged steel, longer lived.
Stem-and-wedge-gate connection is extra-strong, to protect against extra stress.
Seat-rings of stainless steel are superhardened to cut repairs and replacements.
Gate-faces are Malcomized to 800 Brinell to guard against seizing or galling.
Check this 4-Way Protection . . . which you get *only* in Chapman List 960.

The **CHAPMAN VALVE**
MANUFACTURING COMPANY
Indian Orchard, Mass.

BIDDLE *Instrument News*



MEGGER® MANUAL

Tells You How To Test ELECTRICAL INSULATION

40,000 Copies Have Been Distributed

This 94 page manual is in demand by educators as well as practical electrical men. It covers subjects of necessity to anyone who is responsible for electrical equipment.

"Why Test Insulation Resistance?"
"Preparation of Apparatus for Test"
"Tests When Drying Out Wet Apparatus"
"Temperature Correction"
"Methods and Interpretation"

These are but a few of the 14 chapters that are built around the subject of testing electrical insulation resistance . . . and, of course, effective use of the Megger® Electrical Insulation Resistance Tester sold in the U. S. only by the James G. Biddle Co. Supply is limited. Please write on your company letterhead for **INSTRUCTION MANUAL 21-J-P.**

ELECTRICAL PREVENTIVE MAINTENANCE MATERIAL

Written by Practical Electrical Men

BULLETIN 21P8—"The Story of Electrical Insulation Resistance"

BULLETIN 21P9—"Maintenance of Industrial Electrical Equipment"

BULLETIN 21P10—"Cut Electrical Breakdowns"

BULLETIN 21P11—"Getting the Most From Insulation Resistance Measurements"

BULLETIN 21P12—"Preventive Maintenance of Electrical Equipment"

BULLETIN 21P16—"Motor Maintenance with a Check Chart for Alternating- and Direct-Current Motors"

You can tell from Megger Insulation Tester readings if insulation is going bad before it breaks down. Periodic readings provide the means for keeping your finger on the pulse of your electrical equipment, saves time and repair bills.

YOU MAY HAVE ONE OR ALL WITHOUT CHARGE

JAMES G. BIDDLE CO.

• ELECTRICAL TESTING INSTRUMENTS
• SPEED MEASURING INSTRUMENTS
• LABORATORY & SCIENTIFIC EQUIPMENT

1316 ARCH STREET
PHILADELPHIA 7, PA.

JAMES G. BIDDLE CO. B-907 P
1316 Arch St., Philadelphia 7, Pa.

Please mail me: ☐ Bulletin 21P8 ☐ Bulletin 21P9 ☐ Bulletin 21P10 ☐ Bulletin 21P11 ☐ Bulletin 21P12 ☐ Bulletin 21P16

*Name*_____

*Job*_____

*Company*_____

*Address*_____

More EQUIPMENT NEWS

Begins on page 154

hammer piston blow to turn the bit slightly. The automatic drill bit rotation eliminates manually quarter-turning the drill bit, reduces operator fatigue.
Syntron Co, 492 Lexington Ave, Homer City, Pa.

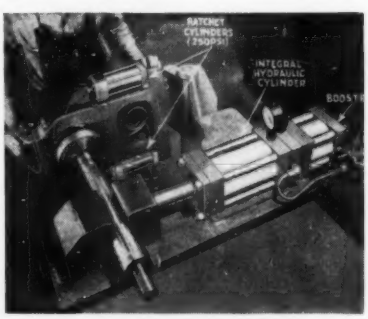
Engine-Driven Welder

153 • Light-weight engine-driven welder, type EW-20 is equipped with complete engine accessories and auxiliary apparatus. Unit can supply 110-v, 60-cycle, single-phase power from a conventional plug-in outlet. Nominal rating of welder is 200 amp, 40 v, 60% duty cycle with current range from 40 to 250 amp.

During off-welding periods, auxiliary power of 3 kw at 100% pf or 2 kva at 80% pf are available for lights and power tools. During welding periods about 300 w auxiliary power is available for lights.

Coupled to a *Ford 120*, 4-cycle, 4-cylinder water-cooled industrial power unit, the self-excited, compound-wound generator functions both as a dc generator and a single-phase alternator for auxiliary power. Welding current is controlled in four ranges by a tap switch and shunt field rheostat. The ac power circuit includes conventional outlets, a voltmeter, and a breaker with overload protection.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

For more data on these items, use post cards p 163. Identify your request with item number.



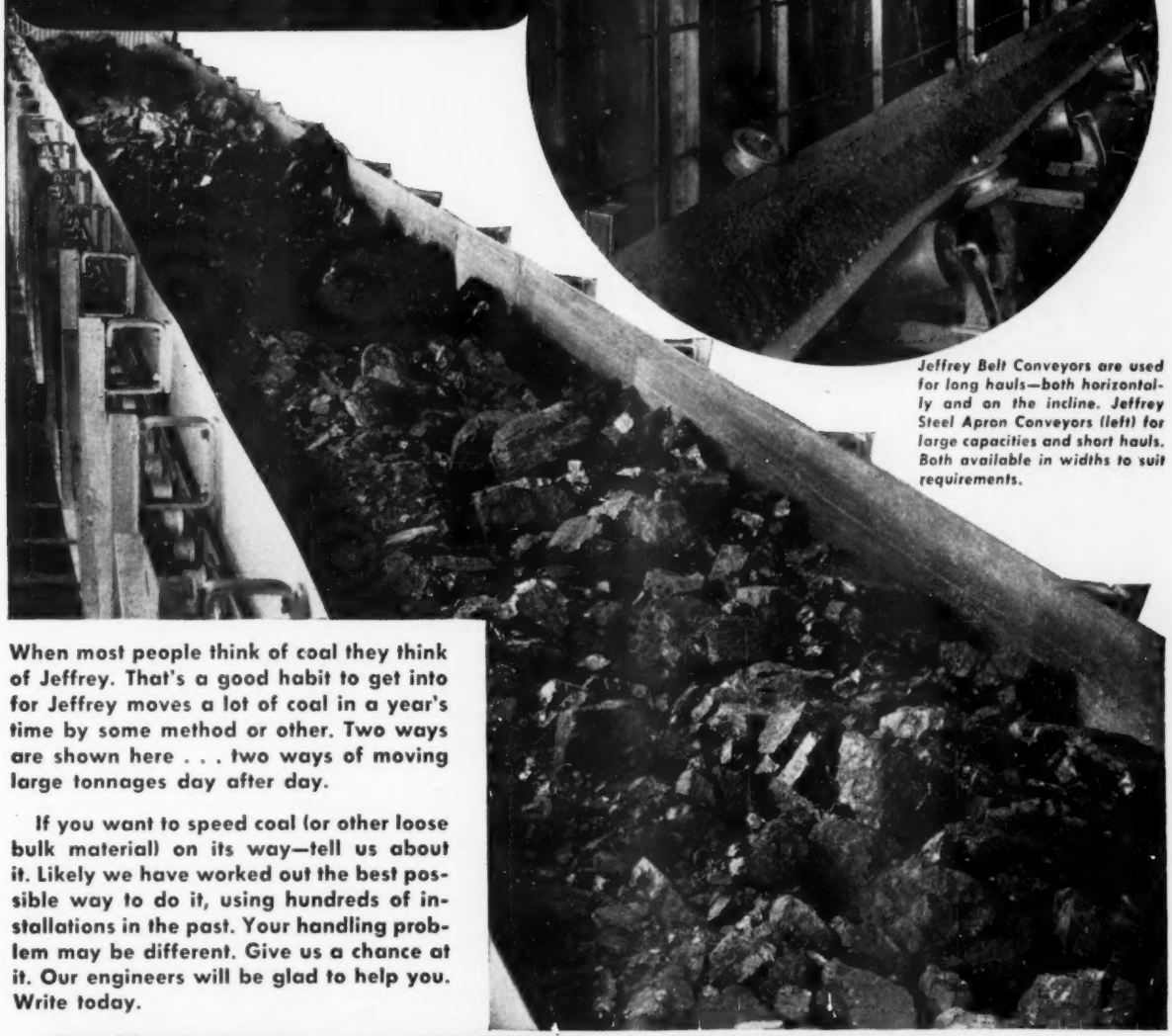
Booster Powered Clamp

154 • Over 15 tons of clamping pressure is developed by using small hydraulic pump operating at 250 psi as powering device. Fluid pressure booster with 6.25 to 1 ratio drives high-pressure hydraulic cylinder that gives final clamp pressure. While device is specially designed for piston rod assemblies, clamp offers advantages in many clamping operations.
Miller Motor Co, 2040 N Hawthorne Ave, Melrose Park, Ill.

Aluminum Paint

155 • Ready-mixed aluminum paint becomes permanently bonded to any metal surface when subjected to heat from 500 to 1600 F. The greater the heat, the more permanent the bond because *Super-Hot*

COAL ON THE MOVE



Jeffrey Belt Conveyors are used for long hauls—both horizontally and on the incline. Jeffrey Steel Apron Conveyors (left) for large capacities and short hauls. Both available in widths to suit requirements.

When most people think of coal they think of Jeffrey. That's a good habit to get into for Jeffrey moves a lot of coal in a year's time by some method or other. Two ways are shown here . . . two ways of moving large tonnages day after day.

If you want to speed coal (or other loose bulk material) on its way—tell us about it. Likely we have worked out the best possible way to do it, using hundreds of installations in the past. Your handling problem may be different. Give us a chance at it. Our engineers will be glad to help you. Write today.

THE JEFFREY MANUFACTURING COMPANY Established 1877

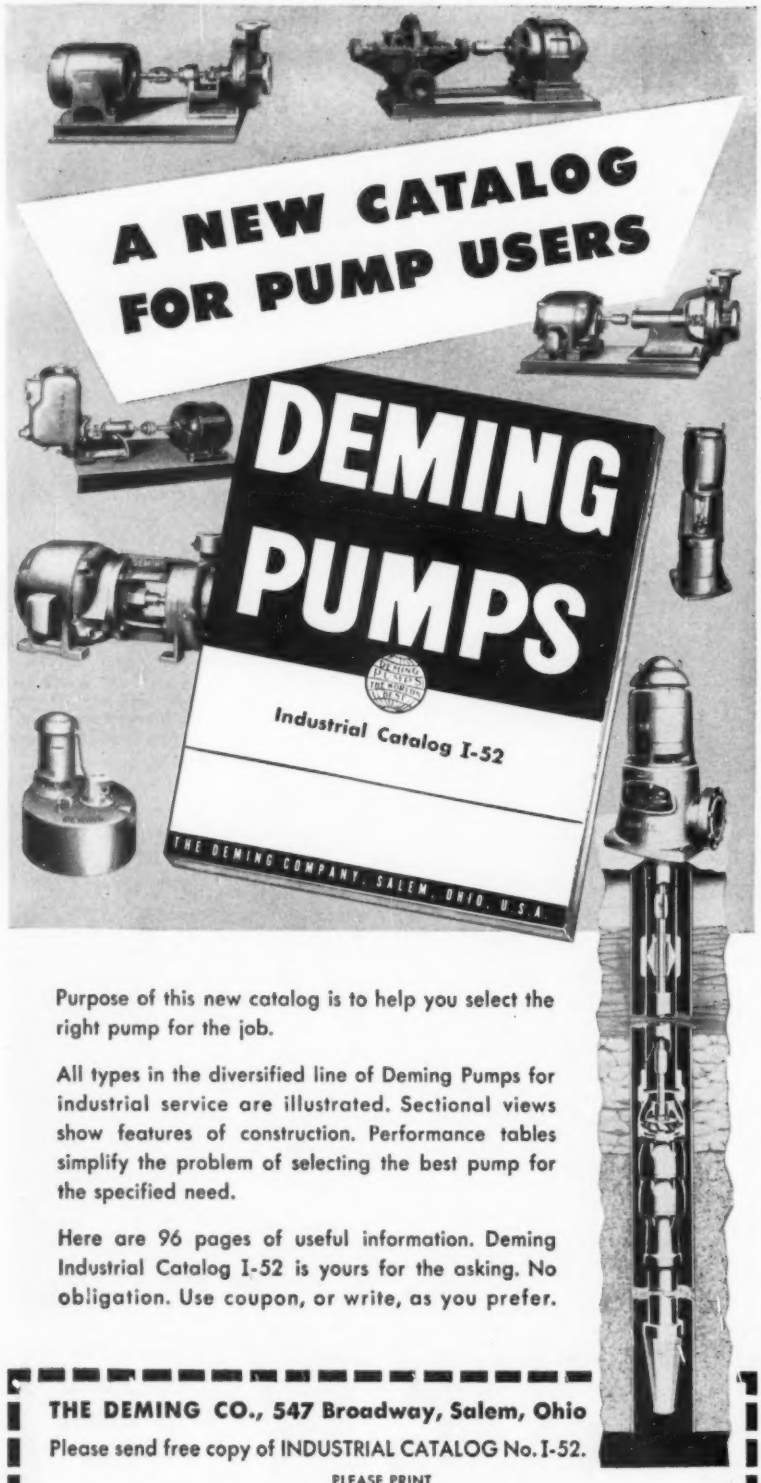
932 North Fourth St., Columbus 16, Ohio

Baltimore 2, Beckley, W. Va., Birmingham 3, Boston 16, Buffalo 2, Chicago 1, Cincinnati 2, Cleveland 15, Denver 2, Detroit 13, Forty Fort, Pa., Harlan, Ky., Houston 2, Jacksonville 2, Milwaukee 2, New York 7, Philadelphia 3, Pittsburgh 22, St. Louis 1, Salt Lake City 1

Jeffrey Mfg. Co. Ltd., Montreal, Canada
British Jeffrey-Diamond Ltd., Wakefield, England
Jeffrey-Galion (Pty.) Ltd., Johannesburg, S. A.
The Galion Iron Works & Mfg. Co., Galion and Bucyrus, Ohio
Galion (Great Britain Ltd.), Wakefield, England
The Ohio Malleable Iron Co., Columbus, Ohio
The Kilbourne & Jacobs Mfg. Co., Columbus, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

JM



Purpose of this new catalog is to help you select the right pump for the job.

All types in the diversified line of Deming Pumps for industrial service are illustrated. Sectional views show features of construction. Performance tables simplify the problem of selecting the best pump for the specified need.

Here are 96 pages of useful information. Deming Industrial Catalog I-52 is yours for the asking. No obligation. Use coupon, or write, as you prefer.

THE DEMING CO., 547 Broadway, Salem, Ohio

Please send free copy of INDUSTRIAL CATALOG No. I-52.

PLEASE PRINT

MY NAME _____

COMPANY _____

ADDRESS _____

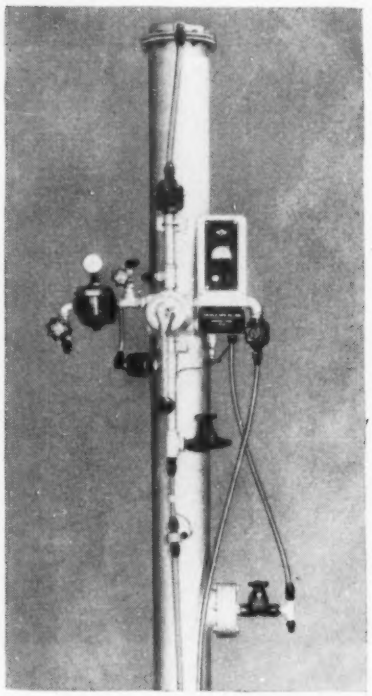
CITY _____ ZONE _____ STATE _____

More EQUIPMENT NEWS

Begins on page 154

alloys itself to the metal. It maintains its brilliance and will not crack, chip or peel. It may be brushed, sprayed or dipped and air dries within 30 min, after which heat can be applied.

The Sheffield Bronze Corp, 17814 Waterloo Rd, Cleveland 19, Ohio



Mono-Column Demineralizer

110 • Penfield M-100 demineralizer has capacity of 4500 grains, is designed for up to 100 gph of high purity water. Unit requires only 2x2x7½ ft of space for installation and connection of influent and effluent. Raw water passes only once through the mono-column of mixed cation and anion resins; effluent is said to be as mineral-free as triple-distilled water.

Water intake can be controlled through a flow meter, purity of effluent is indicated on a purity meter. Regenerating equipment is an integral part of the unit, and regeneration takes less than an hour. Effluent lines and all lines and valves dealing with corrosive regeneratives are plastic. Catalog available.

Penfield Mfg Co, Inc, Att E H Clohessy, 19 High School Ave, Meriden, Conn.

For more data on these items, use post cards p 163. Identify your request with item number.

Magnetic Amplifiers for Precise Current Control

137 • These magnetic amplifiers can be engineered to operate from any single or poly-phase ac supply voltage, varying from a few volts to several hundred. Present uses include control and positioning of var-

To keep production moving, keep valve quality high

FIG. 123

N·M·D

(Non-Metallic-Disc)

BRONZE VALVE

Correctly engineered for long life in handling steam, hot water, cold water, air and gas, oil, gasoline, butane, propane.

Any plant, regardless of type or size, uses valves—bronze, iron, or steel. Industry relies on Lunkenheimer Valves that stay on the job, year-in, year-out . . . helping sustain continuous peak production. And that's why Lunkenheimer quality is so essential today.

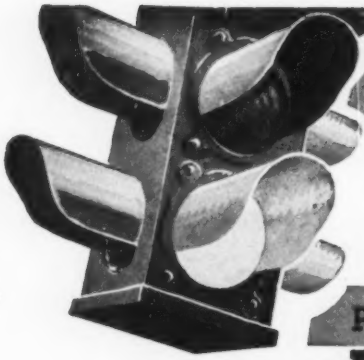
Industry's faith in Lunkenheimer Valves is based on nearly a hundred years of experience with Lunkenheimer design, materials, and workmanship.

BRONZE • IRON • STEEL

LUNKENHEIMER

THE ONE *Great* NAME IN VALVES

L-152-26

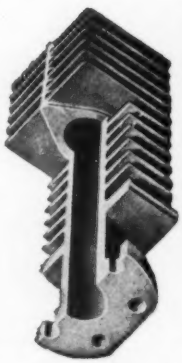


GREEN

PREMIER DIAMOND

ECONOMIZERS

Good Parts are Essential to a Good Machine . . . Let's examine a Green Fuel Economizer—Type 25—and study the major parts.



FINNED CAST ALLOY IRON TUBES WITH DIAMOND SHAPED SECTION

The diamond shape provides less restricted gas flow; easy cleaning and clearview inspection. The fins provide maximum heating surface in given space.

SEPARATE SUPPORTING AND JOINTING FLANGES

Supporting flange is separate from and independent of jointing flange. Jointing flange is not exposed to hot gases. Through bolts rather than studs are used to connect jointing flanges.

CORRECTLY PROPORTIONED, STRONG CONNECTION BENDS

These are designed to provide needed flexibility with strength. Flanges on tubes, bends and manifolds are accurately machined.

Green specially designed Soot Blower assures thorough cleaning.

Green Type 12 Premier Diamond Economizers—the Steel Tube Units—are made up of equally strong and well designed parts. Send for Bulletin No. 169.

THE GREEN *Fuel Economizer* COMPANY INC.

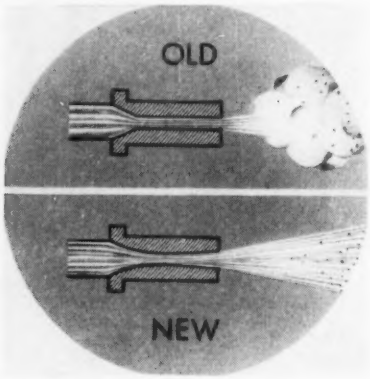
BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

More EQUIPMENT NEWS

Begins on page 154

iable speed motors of all sizes—from fractional to the very large motor drives, regulation of both ac and dc generator voltage, amplification of minute power inputs of thermocouples, strain gauges, etc., into measurable quantities, time delay control, servo-systems, automatic battery chargers, reel controls for synchronizing or governing a battery of motor drives, arc welding controls, metering of dc voltages and currents, rectifier voltage control. Bulletin available.
Karl-Douglas Assoc, 3160 W El Segundo Blvd, Hawthorne, Calif.



Sand Blaster

106 • *Belmont* unit has new venturi-profile nozzle that achieves higher blasting efficiency by eliminating throat choking and muzzle turbulence. Air blast reaches supersonic velocities, increasing grit speed and giving more efficient cutting on the work surface. Sand blaster is portable, comes in 125, 600 and 1000 lb capacities. Bulletin available.
Vacu-Blast Co, Inc, Belmont, Calif.

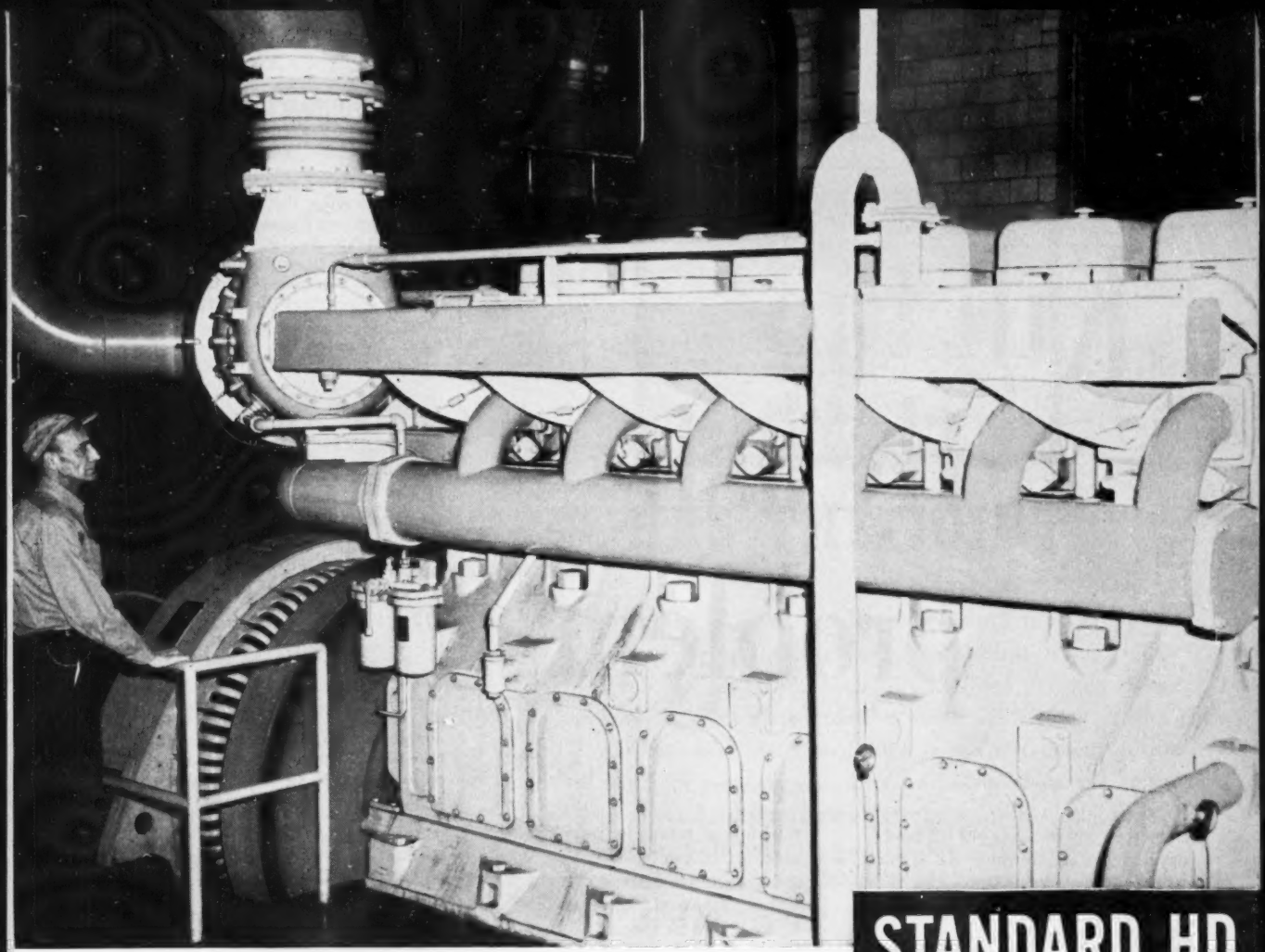
For more data on these items, use post cards p 163. Identify your request with item number.

Thermocouple Head

156 • For protection of thermocouple terminal connections and resistance thermometer bulbs against weather and corrosion, new screw-cover thermocouple head offers high resistance to freezing and rust, complete protection against extreme weather, and application for single or duplex thermocouple or resistance thermometer elements. Bulletin 5601.
Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Sta 213, Wayne & Windrim Aves, Philadelphia 44, Pa.

Wire Fence Painter

157 • *FencPainteR* applicator and enamel make short, economical work of painting wire fences, galvanized iron surfaces, etc. Rolling mop-type applicator and newly developed enamel can cut working time by 85% and cost by 75% over regular brush application methods. Enamel pigment is ground to micro size for better cover-



STANDARD HD
TRADE MARK
OIL

Gets maximum protection with...

• At the time this supercharged diesel engine was installed in a municipal power plant, STANDARD HD Oil had already established an outstanding record for effective lubrication in the plant's other units. In the new unit, STANDARD HD has set a new high for efficient performance.

Most of the plant's load has been carried by the new, supercharged unit. In two years of continuous, hard service, STANDARD HD has supplied clean, protective lubrication. There have been no shutdowns for oil system maintenance. The original fill of oil has never been changed and has remained in excellent condition, as shown by periodic tests of oil samples.

The experience of this power plant, and that of a host of midwest diesel operators, indicates the savings you can make with STANDARD HD. The Standard Oil lubrication specialist serving your section of the Midwest will be glad to give you information about the use of STANDARD HD in plants near your own with which you may be familiar. You can contact the lubrication specialist by phoning your local Standard Oil office. Or write: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY STANDARD *(Indiana)*

If your Management wants to

Kill the fly ash problem

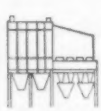
Nineteen years ago, our engineers developed what we think is the most workable way of solving the dust abatement problem. It was the formation of "dust abatement teams", consisting of Buell engineers and the plant engineer—the man who knows *his* particular Fly Ash problem better than anyone else.

This team, drawing on the experience and background of Buell, coupled with the plant engineer's intimate knowledge of his own problem, has been unusually successful in bringing about the kind of results industry has been seeking: efficient elimination of Fly Ash, smoother plant/community relations, improved product quality, and better employee morale.

To learn more about Buell's **3 basic systems** of Dust Collection, Buell's Team-Up with the Plant Engineer, and how they can work for you—send for the new informative booklet entitled, "The Collection and Recovery of Industrial Dusts". Buell Engineering Company, Dept. 50-A, 70 Pine Street, N. Y.

Van Tongeren Cyclone

'SF' Electric Precipitator



Precipitator-Cyclone Combination

Type 'LR' Collector

Dust Hopper Valves

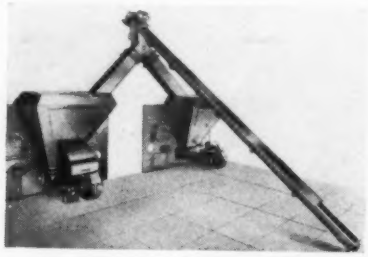
ELECTRIC CYCLONIC ® buell

ENGINEERED EFFICIENCY IN DUST COLLECTION

More EQUIPMENT NEWS

Begins on page 154

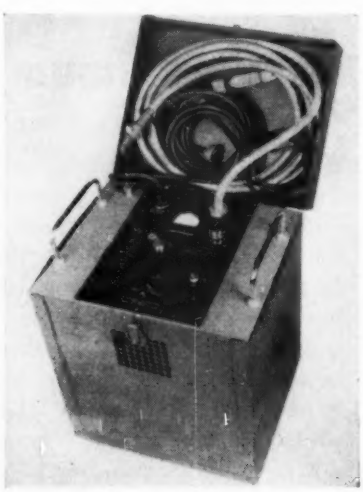
age and is spread more evenly by addition of phthalic esther that creeps over painted surface carrying pigment with it. New solvent addition dissolves rust present and tends to prevent further formation.
Meinhardt Cleaning Materials Co, 2314 W Van Buren St, Chicago 12, Ill.



Screw Feed Coal Handling

112 • *Flow-Tube* screw-feed system conveys up to 10,000 lb of coal per hr. System is the same as used in coal stokers, adapted to a large scale. Trough is inserted in bottom of bin or pile with end left exposed for pickup. Unit will feed one hopper directly, two with a "Y" chute, more with a horizontal arrangement using gate valves. Switches in the hoppers automatically start and stop the screw feed to maintain correct levels. Other bulk materials like grain, pellets, flakes, etc, can be handled.
Canton Stoker Corp, Andrew Place S W, Canton, Ohio

For more data on these items, use post cards p 163. Identify your request with item number.

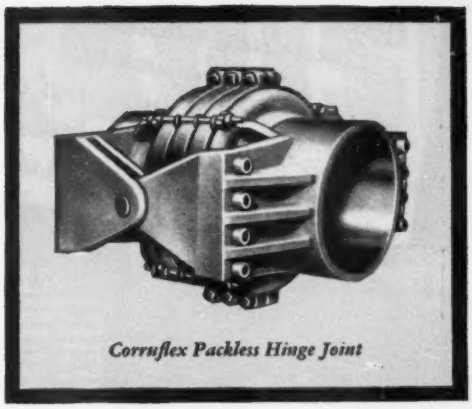


Cable-Fault Detector

136 • Test unit uses a surge generator principle for testing cables. It locates faults quickly and accurately, and prooftests to locate incipient faults.

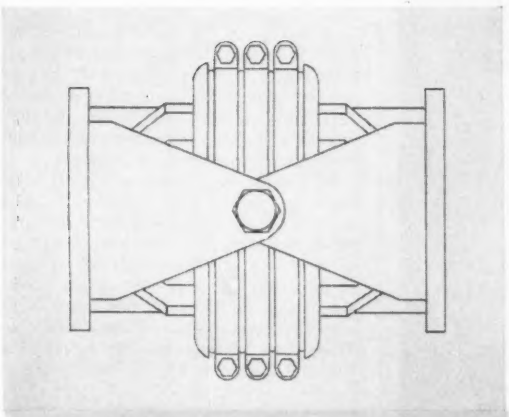
A loud, cracking noise like a pistol shot is produced at fault's location. The "shot" is repeated at 1 to 3 second-intervals. With the impulse applied to the cable, which has been disconnected from the system, opera-

PIPE EXPANSION...?



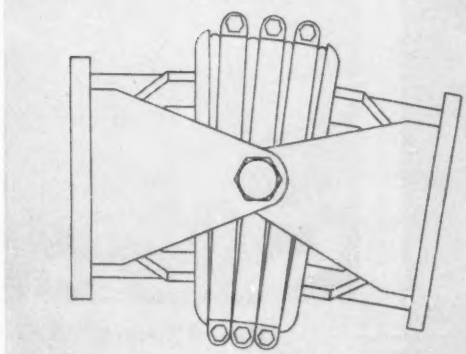
Corruflex Packless Hinge Joint

ADSCO HAS THE JOINT



Hinge Joint in straight position

Hinge Joint in angular position as a result of pipe line expansion



• Because ADSCO makes the world's most complete line of slip and packless expansion joints, it has exactly the right joint to fill each need...The Corruflex Hinge Joint illustrates just one type of ADSCO's packless expansion joints. This joint permits movement in one plane by rotating about its own hinge-pin axis. In the application shown below, Hinge Joints are used to permit the pipe line to expand in three directions without transmitting line pressure thrust to anchors and without causing excessive stresses in the piping. This is a distinct advantage in elevated pipe lines or in cases where there is no structure strong enough to provide for end-anchor thrust... But the Corruflex Packless Hinge Joint is only one joint in ADSCO's complete line of slip and packless expansion joints. Whatever the problem, call an ADSCO representative first... or write for Bulletin 35-51A.

Hinge Joints absorbing axial movement in 3 directions without transmitting pressure thrust

ADSCO ENGINEERED PRODUCTS

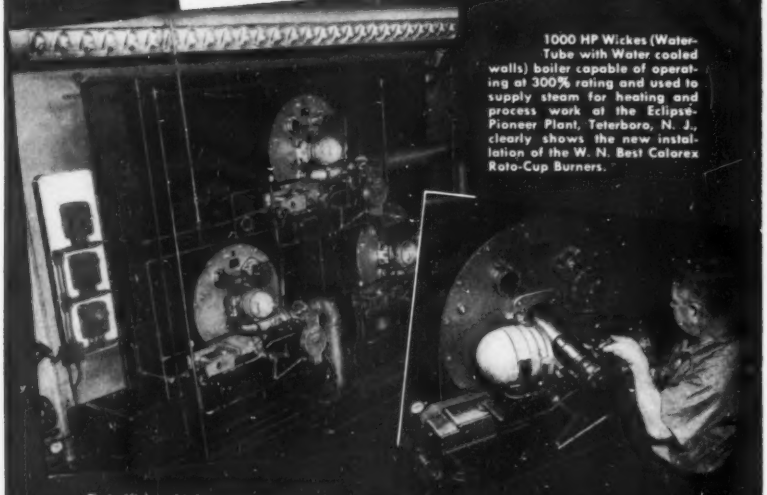
EXPANSION JOINTS
HEAT EXCHANGERS
STEAM TRAPS
STRAINERS
SEPARATORS
METERS

AMERICAN DISTRICT STEAM COMPANY, INC.

NORTH TONAWANDA, NEW YORK

Since 1877

MEMO TO...
Consulting Engineers
...Plant Engineers:
W. N. Best counsel and advice
can help you solve your
fuel burning problems.



1000 HP Wickes (Water-Tube with Water cooled walls) boiler capable of operating at 300% rating and used to supply steam for heating and process work at the Eclipse-Pioneer Plant, Teterboro, N. J., clearly shows the new installation of the W. N. Best Calorex Rota-Cup Burners.

Ernie Hicks, chief engineer, power plant, shows the ease of interchanging Rota-Cup atomizer cartridge on one of the W. N. Best Calorex Rota-Cup Burners.

10 YEARS of Efficient, Maintenance-Free Operation at Eclipse-Pioneer

W. N. BEST
COMBUSTION EQUIPMENT CO.
413-15 ELEVENTH STREET
CARLSTADT, NEW JERSEY

More EQUIPMENT NEWS

Begins on page 154

tor follows the route of cable until he can locate the exact spot where the noise is heard.

The Electrical Distributors Co, Liberty Trust Bldg, Philadelphia 7, Pa.

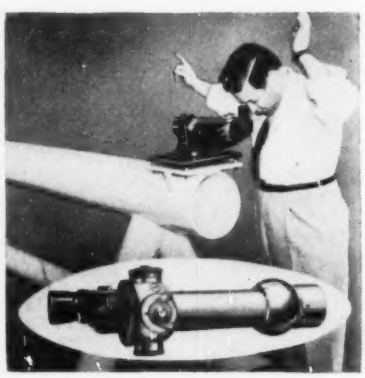
Electrical Insulating Putty

134 • Putty-like electrical insulating compound that comes in a roll and applies like tape. Designated *Scotchfil* brand electrical insulation putty, the black, ⅛-in.-thick material fuses into a void-free mass after application. It is designed not only to insulate, but also to pad sharp edges as on bus bars, build up cable splices, and fill voids around irregular-shaped connectors quickly and conveniently prior to taping.

It is used with plastic electrical tapes since the backing and adhesive of these tapes form an inseparable bond with the material, adding to the mechanical strength of the splice. It has a dielectric strength of 350 volts per mil, and insulation resistance of 100,000 megohms. It will not corrode copper or silver. Bulletin available.

Minnesota Mining and Manufacturing Co, 900 Fauquier St, St. Paul 6, Minn.

For more data on these items, use post cards p 163. Identify your request with item number.



Optical Tooling

114 • *Align-A-Scope* unit for tooling and aligning by telescope permits faster more accurate alignment in aviation, large rotating machinery, etc, industries, where exacting tolerances are required.

High-powered telescopes have magnifying eyepieces designed to be used either parallel or at right angles to the line of sight, can be rotated 360 deg. Built-in optical micrometer can displace the line of

LADISH

Controlled Quality

PIPE FITTINGS

offer dependability safeguarded by advanced metallurgy

Year after year... in all kinds of service... Ladish Controlled Quality Fittings set new standards of reliability. One reason is the strong reliance on technical progress. Every new facility and advanced technique of modern metallurgy is fully utilized to develop desirable physical properties to maximum limits... while unrelenting test procedures continuously safeguard metallurgical soundness and provide users with authentic data proving the complete dependability of every Ladish Fitting.

Ⓛ TO MARK PROGRESS

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF... ONE RESPONSIBILITY

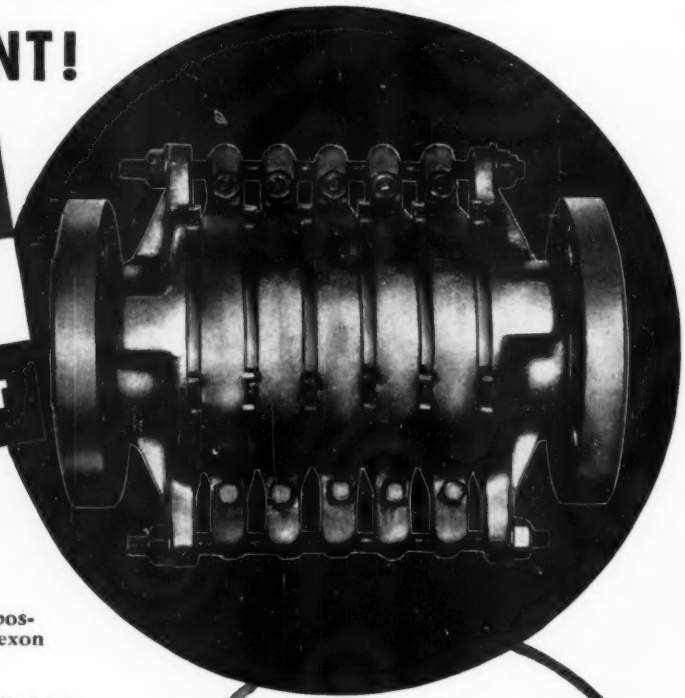
LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
St. Louis • Atlanta • Houston • Tulsa • Los Angeles • San Francisco • Havana • Mexico City • Brantford, Ont.

Now you can have GREATER PIPE LINE MOTION CONTROL IN A MORE COMPACT, LESS COSTLY EXPANSION JOINT!

THE NEW FLEXON EXPANSION JOINT



Continuing research and development at Flexonics Corporation have now made it possible to offer design improvements in Flexon Expansion Joints that provide three basic advantages:

1. The face-to-face (over-all) dimension of a joint to handle a given amount of expansion has been reduced.
2. The reduction in size results in a lower expansion joint cost to handle a given amount of motion.
3. Exhaustive tests prove that these joints provide a maximum of motion commensurate with optimum life.

Coupled with such accepted advantages as compactness, ease of installation and freedom from maintenance, these additional advantages make Flexon Expansion Joints the most satisfactory method of controlling pipe line motion for the majority of installations.

Complete specifications are given in the new Flexon Expansion Joint Bulletin. Check this data before you select or specify expansion joints for your plant. Write for your copy, today.

THREE TYPES AVAILABLE

FREE FLEXING—Available in sizes from 3" through 48" I.D. in copper or stainless steel. Suitable for pressures to 30 psi, temperatures from minus 100°F. to 800°F.

CONTROLLED FLEXING—(Illustrated above) Available in sizes from 3" through 48" I.D. in copper or stainless steel. Suitable for pressures to 300 psi, temperatures from minus 100°F. to 800°F.

FLEXONIFLEX—Integral ring type. Available in sizes from ½" pipe through 6" pipe. Suitable for pressures to 5500 psi, temperatures from minus 400°F. to 1600°F.

Flexonics *Corporation*

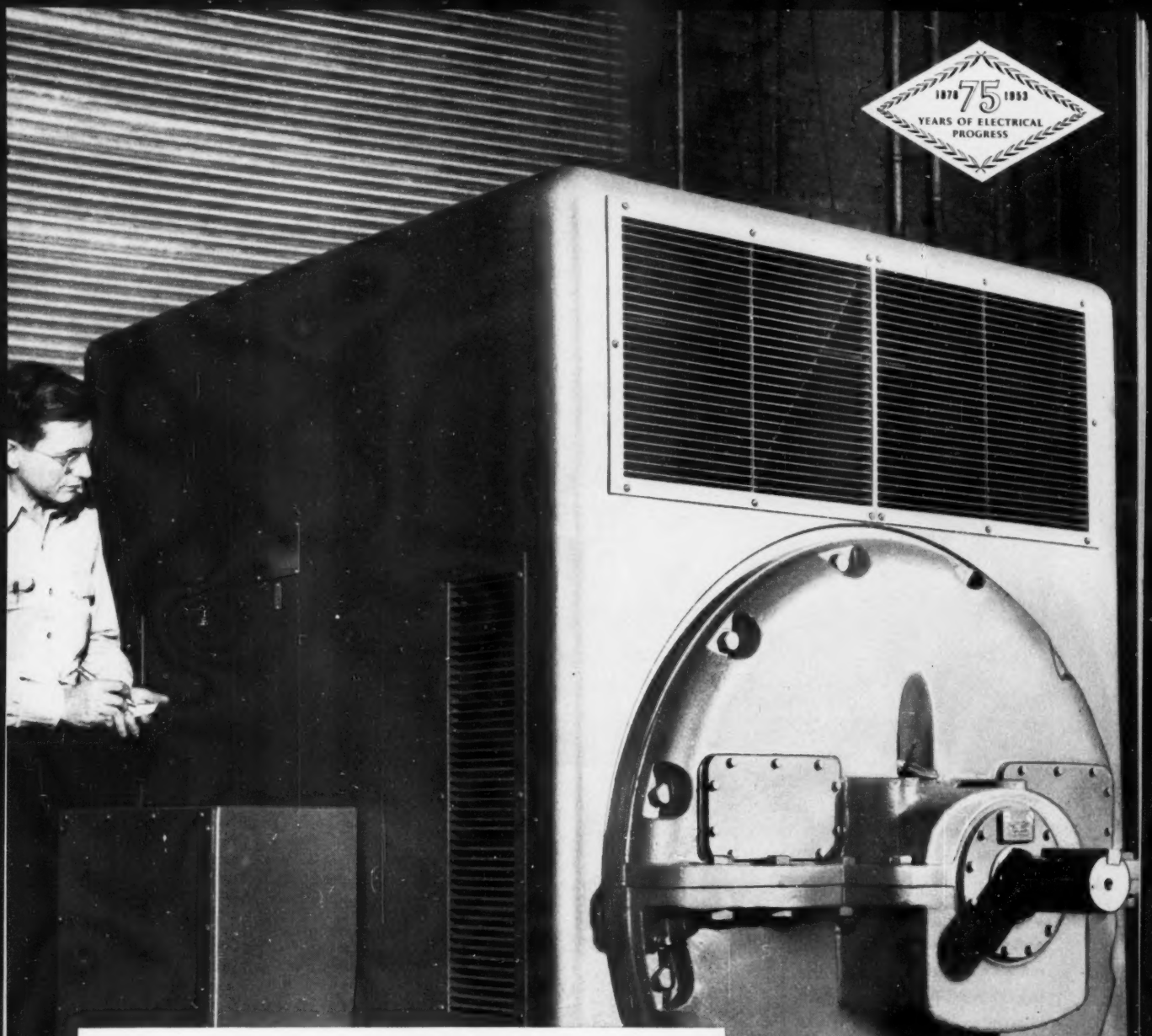
EXPANSION JOINT DIVISION
1301 S. THIRD AVENUE · MAYWOOD, ILLINOIS

FORMERLY CHICAGO METAL HOSE CORPORATION

Flexon identifies products of Flexonics Corporation that have served industry for over 50 years.

Manufacturers of Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals · Expansion Joints for Piping Systems · Stainless Steel and Brass Bellows · Flexible Metal Conduit and Armor · Assemblies of These Components

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario



New G-E Boiler-feed-pump Motor

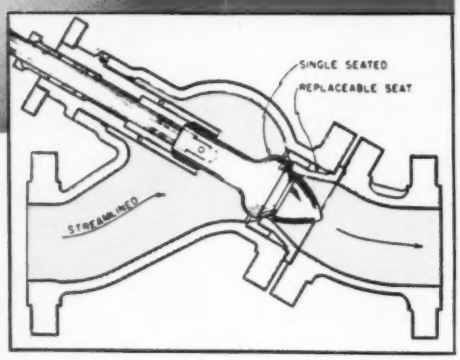
A true power station motor from top to bottom, General Electric's new Boiler-feed-pump Motor offers you many features—among them:

- **Cubical shape reduces width.**
- **Air discharge out top permits mounting motors closer together, improves employee comfort.**
- **Streamlined rotor improves performance—is quieter.**
- **Modern appearance blends with power station styling.**

For more complete information, ask your G-E representative for Bulletin GEA-5813, or write Section 753-1, General Electric Company, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC



The *New CONO-ESS* valve, with its streamlined body contours and single-seated construction, marks a big advance in reducing-valve body design and obsoletes the conventional double-ported, globe pattern control valves. CONO-ESS valve may be actuated by either the revolutionary air-powered gear-drive ROTOMOTOR or the unique air-powered CONO-CYLINDER. You get years of trouble-free service without the headaches usually associated with conventional steam reducing valves.

Available in sizes 1½" to 8", for pressures up to 1500 psi at 1000° F. Rotomotor-operated valves have declutching handwheel for manual operation in case of power failure, eliminating need for expensive bypass. Single-seated construction assures drop tight shut-off when closed.

BULLETIN C-1 gives information on various applications and details of operation. Write for it today.

CONOFLOW CORPORATION
2100 ARCH ST., PHILADELPHIA 3, PA.

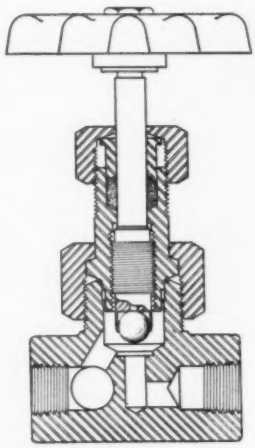
CC-118

Cono-Controls

More EQUIPMENT NEWS

Begins on page 154

sight either vertically or horizontally. Operating dials control and indicate this displacement within .050 in. Device weighs only 18 lb. Auto-collimators and other accessories like targets, bases, mounts, etc, are available.
Joel Fox Co, Inc, 1110 N Seward St, Los Angeles 38, Calif.



Ball Valve

158 • Recommended for working pressures up to 3000 psi, new ¼-in. ball valve gives tight, positive shutoff. Stainless-steel ball closes into a machined, conical seat. The ball, retained at end of stem, is free-rolling. Alignment of ball to seat is piloted by forged-steel, union-type bonnet, fitting tightly to body. Long-stroke stem and packing gland are made of stainless steel for durability and resistance to corrosion. Packing is a preformed, graphited asbestos with a plastic binder and can be easily replaced without shutting off line pressure or interrupting process.
The Foxboro Co, Foxboro, Mass.

For more data on these items, use post cards p 163. Identify your request with item number.

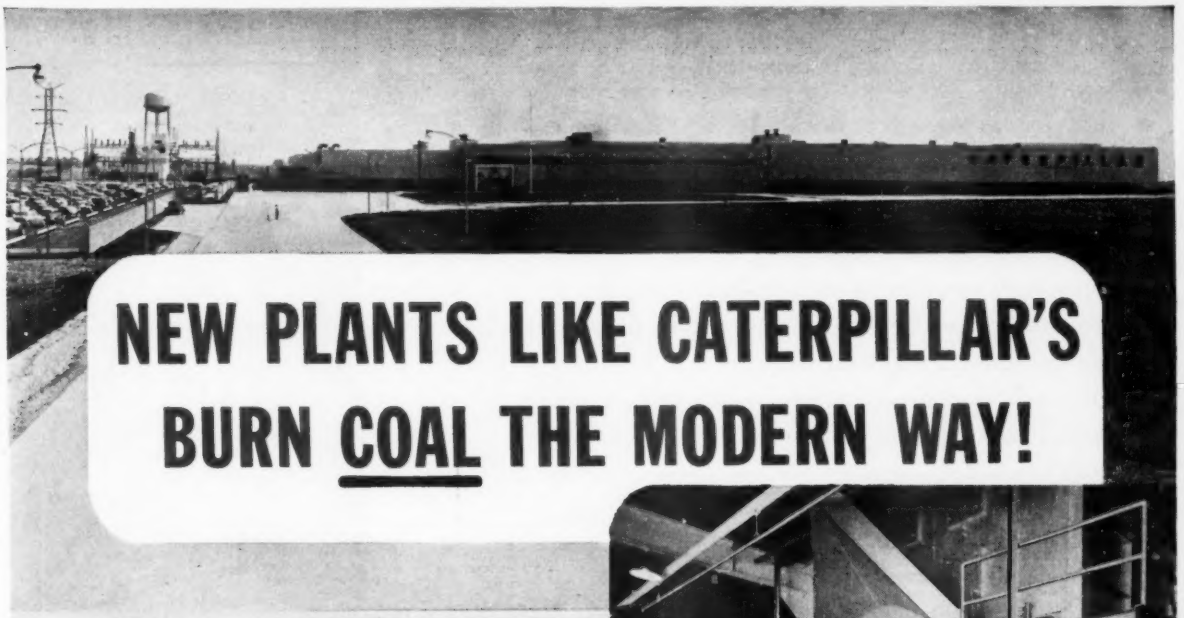
Pipe and Conduit Reamer

128 • *Rigid* spiral 2-S pipe reamer cuts inside burr from pipe and conduit with a minimum of effort or pressure. High-quality tool steel construction assures long life. Capacity ⅛ to 2 in. Furnished with ratchet handle, or as spiral reamer alone.
Ridge Tool Co, Elyria, Ohio

Fluorescent Ballast

159 • Lead-lag slimline ballast combines series economy and size with lead-lag performance and dependability. Ballast is available in 38-, 58-, and 75-watt two-lamp sizes. A 25% reduction in wattage losses now puts lead-lag in the series-ballast class for operating economy.

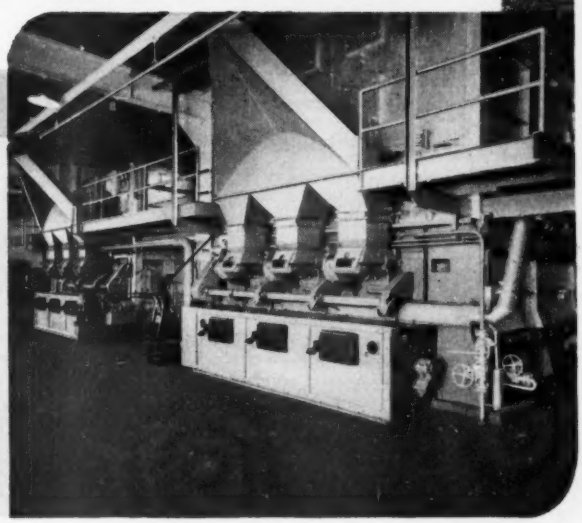
New circuiting and improved production methods have reduced ballast size to 3⅛- by 2⅝- by 13¾-in., with corresponding reduction in weight. Stroboscopic correc-



NEW PLANTS LIKE CATERPILLAR'S BURN COAL THE MODERN WAY!

Mr. R. H. Bachman,
Plant Maintenance Engineer,
Caterpillar Tractor Co., says:

"Our new plant pictured above was recently completed at Joliet, Illinois. A completely up-to-date coal installation was chosen to handle the heat and process steam requirements. To the right is a picture of the firing aisle showing how the boilers are fed by dust-tight chutes from overhead bunkers. This modern equipment makes coal as clean, convenient, and efficient as a fuel can be! The boilers are rated at 80,000 lbs. of steam per hour, but have handled loads as low as 3,000 lbs. per hour without difficulty."



For big savings, build for COAL! That's a good rule to follow whether you've got a new plant under construction or an older plant being modernized.

Up-to-date coal-burning equipment can give you more steam per dollar . . . modern coal- and ash-handling systems can cut labor costs to a minimum. In addition, coal is the only fuel with virtually inexhaustible reserves. And to mine this coal, to better prepare it for customers' special needs, America has the world's most productive coal industry. Thus, coal users get a double advantage—*dependable supply of an even better product, at relatively more stable prices.*

For heat, power, process steam—coal is your best bet! Ask a consulting engineer. He'll show you how to cut both fuel and operating costs by burning coal in a modern plant designed to meet your specific needs.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY *FOR LOW COST*

YOU CAN COUNT ON COAL!

Niagara's HYGROL DRIES AIR BEST

with exact moisture content

- to control your product's quality
- to prevent condensation on your product or material
- to prevent changes due to moist air in contact with your product
- to protect your material from dampness
- to protect your processing of moisture-sensitive material
- to DRY your material or product
- to pack or store your product safe from moisture damage
- to get exact moisture control for the precise atmosphere condition you need
- to provide precise atmospheric conditions for testing
- to increase your air conditioning capacity
- to DRY large quantities of fresh air from outdoors

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

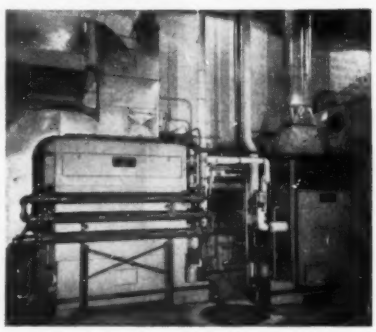
Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.



Niagara Controlled Humidity Air Conditioning

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

See Niagara Blower's Exhibit at the POWER SHOW Booths Nos. 23-24-25 Grand Central Palace December 1-6.

For complete information write

NIAGARA BLOWER COMPANY

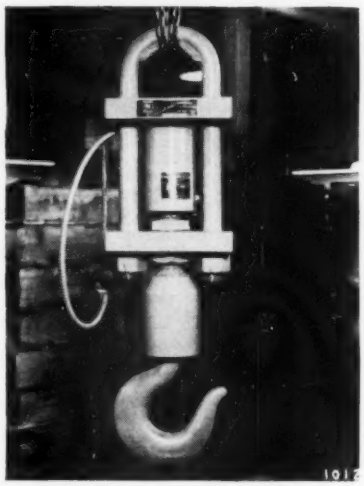
Dept. P, 405 Lexington Ave., New York 17, N. Y.

District Engineers in Principal Cities of United States and Canada

More EQUIPMENT NEWS

Begins on page 154

tion as well as long lamp life is obtained through the lead-lag circuit.
Westinghouse Electric Corp, Box 2999, Pittsburgh 30, Pa.



Electronic Crane Scales

113 • Electronic scales will weigh crane loads up to 10 tons per hook. They use *Baldwin* SR-4 load cell to translate changes in weight into changes in electrical energy. Force exerted may be recorded either in the crane cab or remotely.
Streeter-Amet Co, 4101 Ravenswood Ave, Chicago 13, Ill.

For more data on these items, use post cards p 163. Identify your request with item number.

Automatic Smoke Filter

109 • Instrument uses filter-paper method for evaluating coal smoke. It aspirates air at the rate of ¼ cu ft per minute through a one-inch diameter circle of filter paper that is supplied as tape from a spool. Sampling time is six hours so that both blackness and chemical or physical analysis can be made. At the proper time a windup motor shifts the tape in preparation for the next sample. Simple, low-speed diaphragm pump, specially designed for the application, handles the air.
Research Appliance Co, Box 413, West View Rd, Pittsburgh 9, Pa.

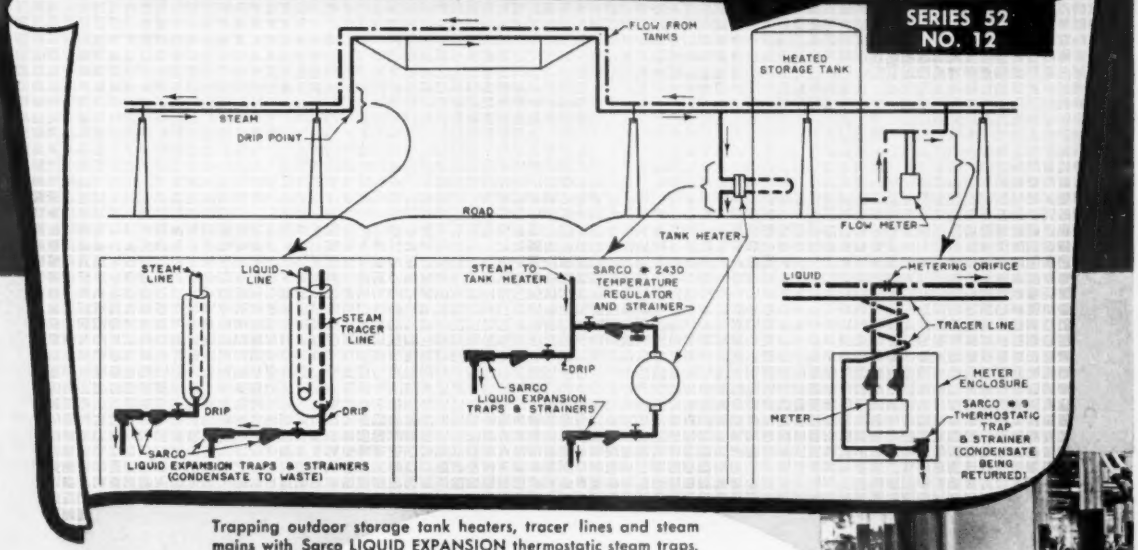
Oil-Fired Furnace

160 • With bonnet output of from 80,000 to 180,000 Btu, new horizontal pressure atomizer oil-fired furnace is delivered completely assembled and is easily installed by suspension from integral eyebolts. Burner parts are rigidly frame supported, and both blower and motor are cradled in rubber.

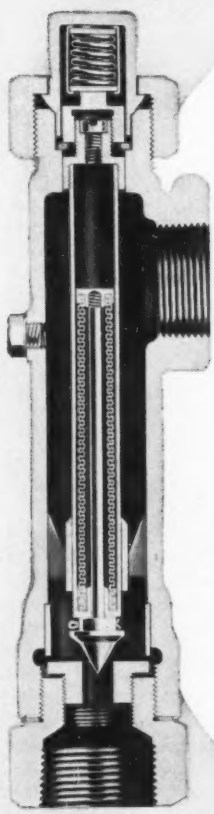
Spun glass filters are provided; filter racks can be mounted on top, bottom, end or either side of furnace. Automatic feed-type humidifier is optional. Heavy 12 gage steel is used and cabinet is finished in baked enamel.
Iron Fireman Mfg Co, Cleveland 11, Ohio

Steam Trapping OUTDOORS

SERIES 52
NO. 12



Trapping outdoor storage tank heaters, tracer lines and steam mains with Sarco LIQUID EXPANSION thermostatic steam traps.



Sarco No. 871 LIQUID EXPANSION thermostatic steam trap for outdoor applications. Discharges condensate in a continuous stream at temperatures always below 212°F.

Have you the problem of removing air and condensate from outdoor storage tank heaters, tracer lines and mains?

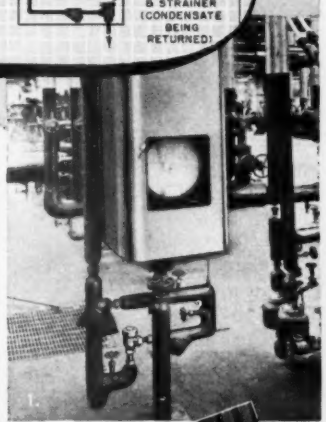
Sarco, and Sarco alone offers you a special LIQUID EXPANSION thermostatic steam trap designed especially for this type of installation.

The Sarco LIQUID EXPANSION thermostatic steam trap has these advantages:

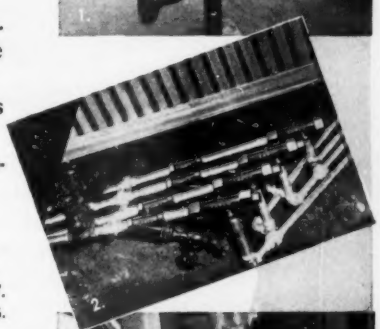
1. Needs no protection against freeze ups.
2. Discharges condensate at adjustable temperatures below 212° F., making it possible to use some of the sensible heat of the condensate.
3. Small size, light weight, large capacity — as easy to install as a pipe elbow.
4. Not affected by water-hammer, vibration, pressure pulsations or superheat.
5. And just as effective indoors too.

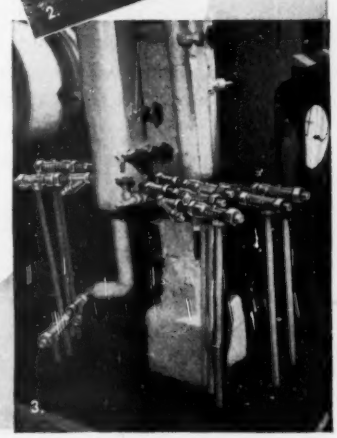
Write for new Bulletin 260-4, free for the asking.

SARCO COMPANY, INC., Empire State Bldg., New York 1, N. Y.
SARCO CANADA LTD., TORONTO 8, ONT. REPRESENTED IN PRINCIPAL CITIES.



1. Removing air and condensate from coil heaters in flow meter cabinets with Sarco No. 9 balanced pressure thermostatic steam traps.
2. Steam jacketed asphalt lines and a jacketed pump drained by Sarco No. 871 LIQUID EXPANSION steam traps. (Globe Roofing Products Co. Whiting, Ind.)
3. Sarco No. 871 LIQUID EXPANSION Steam Traps draining air and condensate from steam tracing lines.





SARCO
improves product quality and output

416

an ACCO product

PRESSURE Seals It!

• This R-P&C Valve has an inside bonnet which is forced tightly against a special metal sealing ring by the pressure in the valve. It stays tight under conditions of varying pressure, and the compensating wedge makes it easy to open and close. Also made as a globe valve.

Designed for high pressure, high temperature service. Cast steel construction. Sizes from 2½" to 12"; pressures to 1500 lbs.; temperatures to 1100° F.

For further information, see your R-P&C distributor or write the nearest R-P&C district office.

ACCO

R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver
Detroit, Houston, New York, Philadelphia, Pittsburgh,
San Francisco, Bridgeport, Conn.

R-P&C valves

More TECHNICAL BRIEFS

Begins on page 150

anion exchangers can be operated under pressure.

A case history, the Reading Hospital, Reading, Pa., is discussed along with alkalinity control operating benefits. *ESWP Paper. No number.*

Corrosion and Its Control. *By J F Wilkes and R G Dalbke, Dearborn Chemical Co.*

Water treatment procedures to prevent scale, corrosion, bacterial growths and wood deterioration must be correlated to give protection throughout a cooling system. Some water treatment methods that solve certain problems can contribute to corrosion in the absence of careful application and regulation. What's more, procedures for treatment in one type of cooling system may be totally unsuited in others. For example, closed recirculating systems employ methods not economically feasible for open recirculating designs and definitely out of the question for once-through cooling.

The chief cause of corrosion is dissolved oxygen present in the water. The reaction of this dissolved oxygen with metals accelerates with temperature rise, producing pits and depressions in the metal.

The authors go on to discuss the role of the metallic ions as well as the chloride and sulfate ions in the battle for corrosion control. The application of the Langelier Index and the subjects of galvanic action, impingement attacks, cavitation come in for consideration.

Several of the more widely accepted treatments are advanced and their strengths and weaknesses analyzed. *ESWP Paper. No number.*

Control of Resinous Materals in Low Pressure Boiler Feedwater. *By W L Andrews, Bird-Archer Co.*

Organics in natural surface waters can color boiler water to the point where testing and routine control is difficult. Some organics bring on sludging and troublesome scale characteristics. In the region discussed by the author—the northern part of Ontario, involving many lumbering pulp and paper plants—these problems are highly specialized.

Intercrystalline corrosion seemed to be rampant in boilers in this region. But in 1946 tests showed the trouble was not this at all. Actually it was a transcrystalline fracture brought on by stress of a thermal nature. The cause was a hydrocarbon deposit, some form of turpene, an organic found in the nat-

Directions for ordering papers on p 152

This Mead-Morrison Unloader features a gearless hoist (slow speed motor coupled direct to drum shaft) and variable voltage control.

SPEEDY unloading SIMPLE operation

Typical of Mead-Morrison Rigs

The illustration shows a 6-ton Mead-Morrison coal unloader on the Ohio River . . . one of the many Mead-Morrison rigs that are making records for speedy, economical, dependable operation at steel mills and power plants.

The rapid unloading of river coal barges is further aided by Mead-Morrison barge haul machines. Our engineers will be glad to help you plan your new unloading facilities or give you information for increasing the capacity of your present equipment.

MEAD-MORRISON

DIVISION OF McKIERNAN-TERRY CORPORATION · MANUFACTURING ENGINEERS · HARRISON, N. J.

how to
select
design
purchase
and install...
floor gratings

send for new
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tells how
to buy
floor
gratings

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Green Lane, Elizabeth, N. J. P-1

Gentlemen:

Please send me Borden Catalog No. AT-253.

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co. name.....

st. and no.....

city, state.....
See our Catalog in Sweets

More TECHNICAL BRIEFS

Begins on page 150

ural water supplies of that locality.

Because of the nature of turpene it was reasoned that treatment with sodium nitrate would solve the problem. Dissolved solids would be held to a tops of 1500 ppm through blowdown. Results were good. The author feels that this treatment or similar oxidizing agents will curb the feedwater headaches that resinous materials will otherwise produce. *ESWP Paper. No number.*

Oil Removal From Condensate by Diatomite Filtration. *By G R Bell, Johns Manville Co.*

Oil in boiler feedwater is widely recognized as a potential danger. The older boilers suffered from foaming, priming and some loss of fuel economy. Newer higher rated equipment, though, can find the oil carbonizing and this could produce tube-bagging or burnout.

The Maritime Commission early in World War II substituted Uniflow engines for turbines for the main propulsion of several ships, namely the CVE's, LSD's and deep sea tugs of the Navy. A study was made of the various filters suitable for oil removal. Two diatomite filters, absorber and stripper types, were eventually chosen.

The absorber removes the oil in a single process and the stripper uses a thin layer of diatomite to break any oil emulsion and then lets a mechanical separator remove the coalesced oil. But the Maritime Commission found the absorber or body feed system to be the most effective.

Oil removal by this means is effected over a wide range of temperatures (preferred 120-180 F) with costs considered reasonable by the author. *ESWP Paper. No number.*

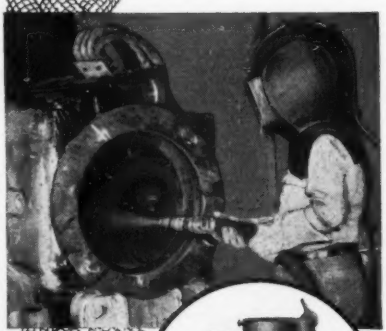
Effect of Operating Pressure on Carbon Dioxide Content of Steam. *By J Maguire, WH&LD Betz Co; and R E Winston, Day & Zimmerman.*

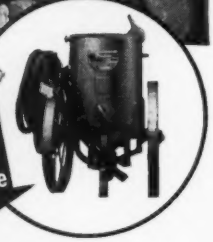
Straub and Larson back in 1932 showed that decomposition of the carbonate and bicarbonate salts normally found in natural water for feedwater use was a function of operating pressures between the range of 150-1500 psi. The author's investigation shows that the same condition holds, only more so, for the pressure range from 15-100 psi. As an example the rate of decomposition at 15 psi (250 F) is only half that at 100 psi (338 F).

The authors summarize their data in graphs that indicate the effect of both

Directions for ordering papers on p 152

It's "CORNY"
...but it's the best way to CLEAN motors, generators, turbines!





PANGBORN
AC-4
Blast Machine

- CUTS DOWN-TIME
- CLEANS WITHOUT SOLVENTS
- ELIMINATES DRYING
- ELIMINATES TOXIC AND EXPLOSIVE DANGERS

THE new Pangborn AC-4 Blast Machine cleans motors, generators and turbines faster . . . cleaner . . . and lets you use them sooner because there's no waiting for parts to dry. In fact, dangerous solvents that can lead to explosions, caustic action, and toxic poisoning are completely eliminated!

The AC-4 uses soft, 20-mesh corncob grits to rapidly remove dirt, grease, old paint, etc., in one-third the time, and at 90% less cost than old-fashioned methods. GET FULL DETAILS . . . write, telling us what you clean, to: PANGBORN CORP., 90 Pangborn Boulevard, Hagerstown, Md.

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment

Pangborn
BLAST CLEANS CHEAPER
with the right equipment for every job

"Tycol Aturbrio Oils have high oxidation resistance... cut turbine shut-downs"

Tycol Aturbrio Oils are unexcelled for long turbine life. They provide resistance to oxidation and protect against corrosion.

Further, Aturbrio Oils have excellent demulsibility properties. Turbine Operators using Aturbrio report minimum wear . . . utmost turbine efficiency . . . greatly decreased maintenance costs.

For complete information, call or write the nearest Tide Water Associated Office.

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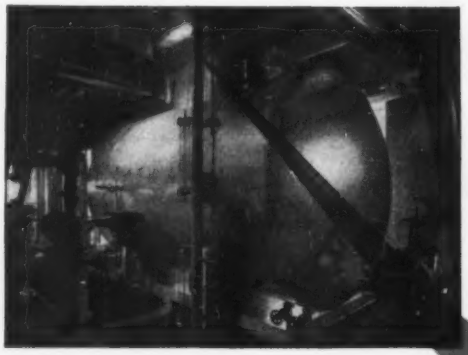

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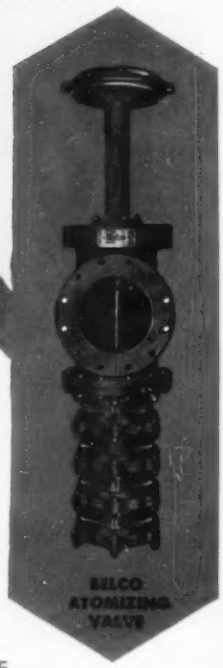

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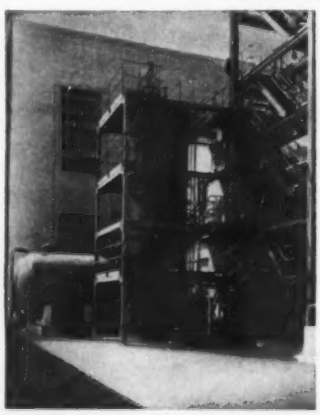

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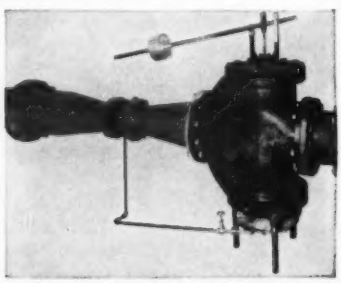

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More TECHNICAL BRIEFS

Begins on page 150

operating pressure and bicarbonate alkalinity of feedwater on percentage decomposition and carbon dioxide content of steam. Decomposition seems independent of steaming rate. A higher rate occurs with sodium carbonate than occurs with sodium bicarbonate.

Operating evaporators at the lowest pressure consistent with operating economy minimizes carbon dioxide in the steam and decreases the corrosion problem where the evaporator distillate is condensed. *ESWP Paper. No number.*

High Pressure Design

A High-Speed High-Pressure Gage. *By P L Edwards, U S Naval Ordnance Labs.*

The design and tests of a pressure gage for measuring high-speed transient pressures up to 100,000 psi is described. This gage was designed for use with the Naval Ordnance Laboratory adiabatic compressor.

The pressure gage consists of a thin x-cut quartz crystal cemented to a steel plate. Pressure bends the plate and stretches the crystal, producing an electrical signal proportional to the pressure. Frequency limitations are determined by the natural modes of vibration of the steel housing.

The gage response was tested by both impulse and step input signals. Natural frequency is about 80,000 cps with a damping about 2% of critical. These tests show that the gage response can be approximated by a resistance-inductance-capacitance circuit. An analysis on this basis of the gage distortion of the expected pressure pulse indicates a maximum error in pressure measurement of 6%. If necessary a corrective circuit may be used to reduce this to about 1.5%.

The gage has been calibrated up to 50,000 psi. There is some question as to whether or not the crystal will fracture before 100,000 psi, the maximum desired pressure, is reached. If it does, the simple expedient of increasing the plate thickness will reduce the crystal strain and prevent breakage.

The gage sensitivity is high. The output is about one volt across 1000 mmf for a pressure of 10,000 psi. *ASME paper. No. 52-IIRD-7.*

Gaskets for High-Pressure Vessels. *By A R Freeman, American Instrument Co.*

It has been estimated that, if mating surfaces are held together to make a pressure-tight seal, tolerances of molec-

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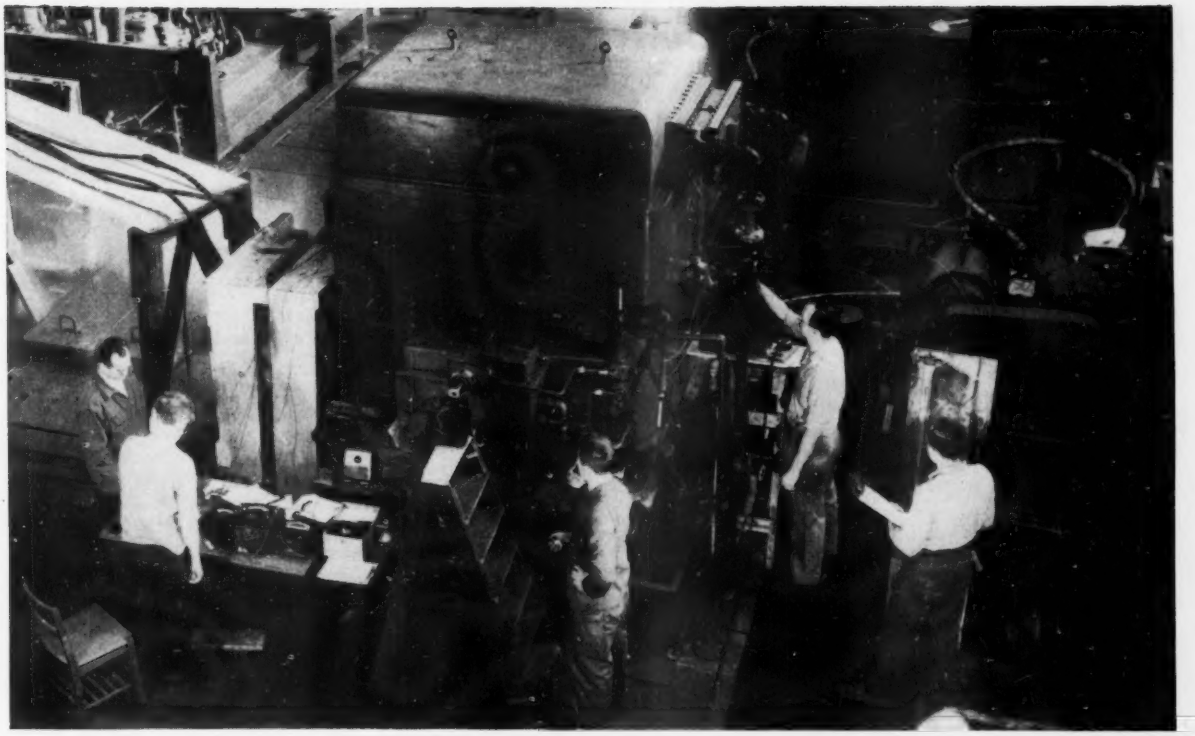


Totally enclosed 3500 hp motors pass final exam

Final tests are completed on these new 1800 rpm, pedestal bearing type E-M Squirrel-Cage Induction Motors. Among the largest high-speed motors built for pumping, these motors are typical of a trend toward total enclosure in big motor design.

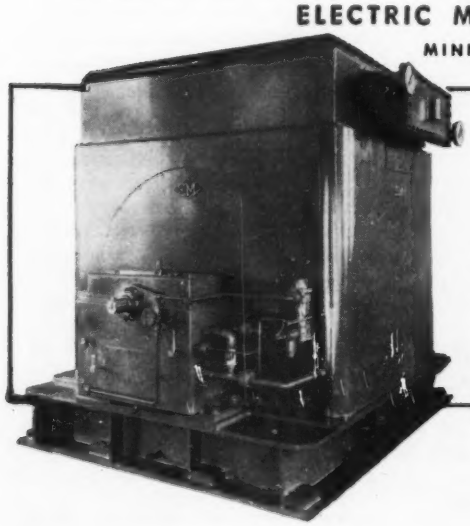
No outside dust or airborne particles reach the motor . . . the sealed recirculating ventilating system limits foreign matter to the small amount already present in the system. Mounted on top of the motor, special air-to-water coolers dissipate motor heat effectively without creating excessive engine room temperatures. Motor interior stays clean and cool, and the total enclosure keeps objectionable noise to a minimum.

A forced-feed bearing lubrication system assures continuous proper lubrication. Specially designed insulation has high dielectric strength, resists moisture effectively. Precise rotor balancing techniques make for smooth running at high speed.

You will find these advantages of E-M totally enclosed motors especially significant where cooling water is readily available, such as on pumps, mixers or rubber mill drives. See your nearest E-M sales engineer for his specific suggestions.

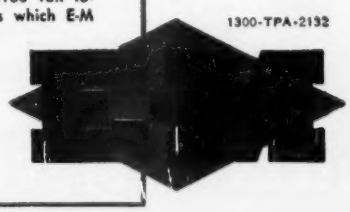
ELECTRIC MACHINERY MFG. COMPANY

MINNEAPOLIS 13, MINNESOTA



FIRST OF TEN...

This is the first of ten 3500 hp, 4160 volt totally enclosed pedestal-type motors which E-M is building. Totally enclosed motors are especially economical in terms of minimum maintenance and continuous service. To find out how E-M engineers solve high-speed induction motor design problems, write for Publication No. 210.



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More TECHNICAL BRIEFS

Begins on page 150

ular magnitudes should be maintained. Such micro surfaces, are, however, difficult to produce and are highly impractical from a commercial standpoint. Gaskets obviate their necessity.

As originally developed, a gasket was introduced between the two mating surfaces. The gasket, being made of a relatively soft material, would deform and thus effect a seal by filling the surface irregularities of the mating pieces. For low pressures, gaskets of rubber, leather, cork, etc, may be placed in a joint. But for higher pressures, and under severe conditions, gaskets made of soft substances tend to extrude and make maintenance of joints difficult for general use.

There are several different ways that gaskets may be used to seal pressure vessels. The author gives a number of these and explains the working points of each. *ASME paper. No. 52-IIRD-5.*

Direct Reading Indicated Power Meter. *By Y T Li, Massachusetts Institute of Technology.*

Indicated power is the output of an engine before mechanical losses are subtracted. It is of particular interest to engine designers because it represents the effectiveness of the chemical-thermal-mechanical energy transformation processes. The comparison between indicated power and brake power gives the true value of engine friction power, also an important factor in engine design. In a multiple cylinder engine, measuring indicated power of each cylinder discloses how the load is shared among the various cylinders. This permits accurate balance of load among cylinders.

Indicated mean effective pressure, usually abbreviated as IMEP, is another term frequently used in engine specifications. It is equal to the indicated mean power divided by the product of engine speed, piston displacement and a conversion constant. Since the speed of the engine is readily determined and the other factors are known constants, both the IMEP and indicated mean power are considered as determined when one of them is known.

An indicated power meter that reads the product of IMEP and engine speed has been developed. It consists of an electromagnetic piston speed signal generator, a strain gage pressure receiver, a suitable multiplying means and an indicating system. The product of the piston speed signal and the pressure signal yields the indicated power signal. A field calibration method using a syn-

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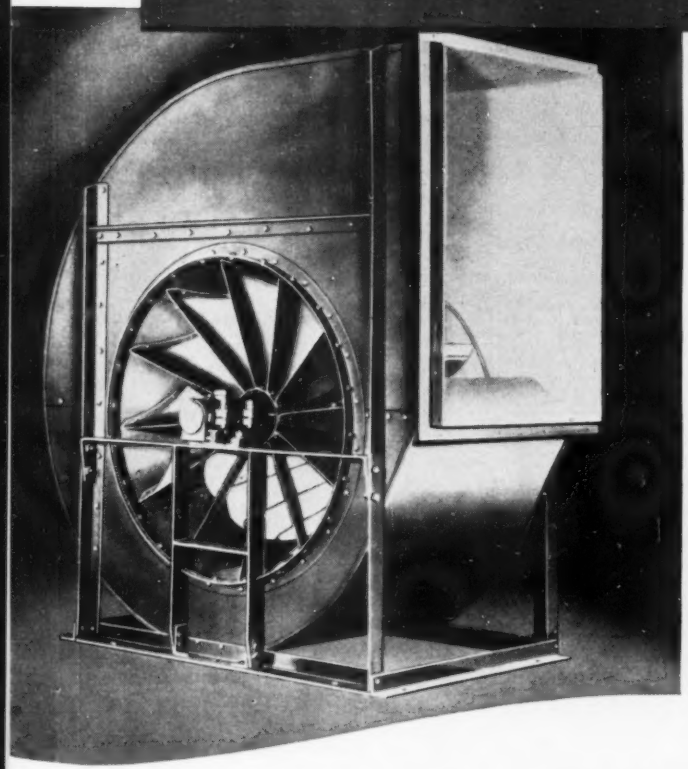
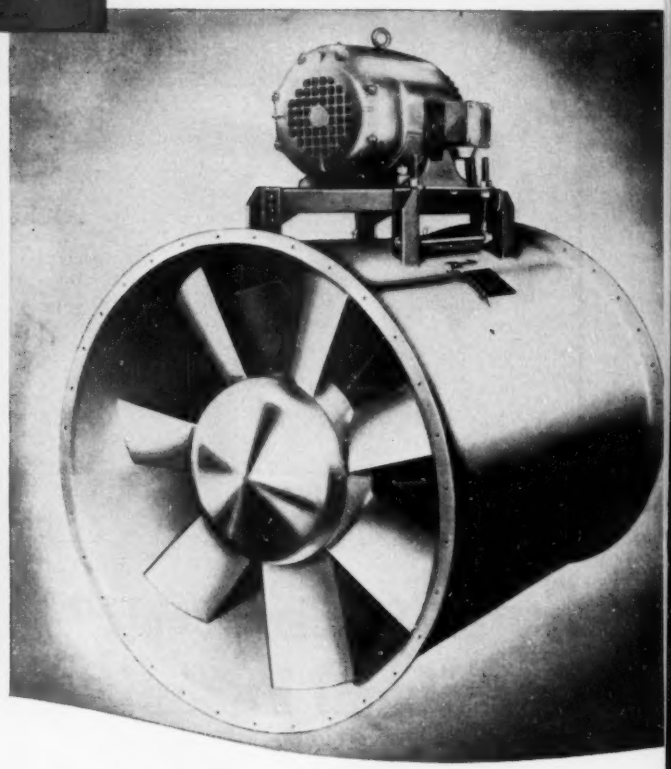
Let's not overlook QUALITY



The quiet, efficient Type "B" Vaneaxial Fan is one reason why "Buffalo" has earned—and kept—the reputation "First for Fans."



"Buffalo" Limit-Load, the fan that supplies the air for many of the world's finest ventilating and air conditioning systems.

Quality is a relative term—it can be poor, medium, high or the best. We think you should evaluate fans and air cleaning and conditioning equipment according to the "Q" Factor.*

Engineers are not easily misled when they turn an engineering eye on mechanical things. They know that efficiency is important, and that rugged construction, ease of assembly and repair are also desirable. They value simplicity if it's not for economy of manufacture. Above all, we believe, they admire reliable, long life performance.

Because in seventy-five years of manufacturing fans, air cleaning and conditioning equipment we have stuck to an original idea—"build it the best we know how," we welcome your critical inspection of Buffalo products. You'll find that both design and construction contribute to their record for long life on the job.

Engineering sales repersentatives in principal cities are anxious to work with you.

**The "Q" Factor—The built-in Quality which provides trouble-free satisfaction and long life.*

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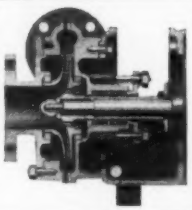
Where Space is a Problem...

GOULDS Fig. 3650
Full open top construction permits ready access to gland and stuffing box—particularly desirable when pump is not in a readily accessible position.



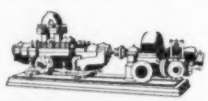
Goulds "Close-Cupld" Centrifugal Pump is the Answer

This versatile pump, simple and sturdy in design, is an entirely self-contained unit. Its close-coupled design eliminates coupling and assures perfect alignment with freedom from vibration.

The "Close-Cupld" needs no space-consuming special foundation . . . no unwieldy base plate to support pump and motor. As a result, installation costs are low.

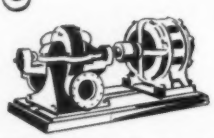
Hundreds of these pumps are doing a wide variety of jobs in factories, steel mills and chemical plants. Interchangeable parts keep inventories low. Available in a wide variety of sizes. Capacities to 2000 G.P.M. Heads to 400 ft. Bulletin 710.1 gives complete specifications. Send for it today. Or call your Goulds representative for the full story.

Other GOULDS Widely Used Throughout Industry



GOULDS Fig. 3360—High pressure multistage centrifugal. Full range of capacities and pressures. Bulletin 722.5.

GOULDS Fig. 3047
Nonclogging impeller of this vertical sump pump will handle water containing solids or fibrous materials.



GOULDS Fig. 3450—Double-suction, single-stage Goulds centrifugals. Up to 15,000 G.P.M. Heads up to 500 ft. Bulletin 721.2.

MEMBER

Goulds PUMPS INC.
Seneca Falls
New York

More TECHNICAL BRIEFS

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thesized pressure signal is described. Performance of the meter in actual engine operation as compared with results from graphical reduction of pressure data taken from a balanced pressure indicator showed good agreement under various engine conditions. *ASME paper. No. 52-F-17.*

Fuels and Firing

Pressure Operation of Large Pulverized-Coal-Fired Boilers. *By G W Bice and W M Yeknik, American Gas & Electric Corp.*

In 1946 a detailed study was made towards applying a special pressure-tight steel casing to the boilers for two projected 150,000-kw capability units. This was to permit operation with forced draft only. Factors influencing the decision to proceed with this type of construction make up this paper.

Operating histories, as affected by the pressurized construction, are reviewed for these two units and for four subsequent additional units of similar design. The principal difficulties that were encountered are enumerated and measures that were taken to overcome these difficulties are discussed. Static pressure operating levels, auxiliary power and thermal efficiency comparisons are given for pressure operation versus suction operation. *ASME paper. No. 52-F-32.*

Steel Works Power Plants. *By R W Worley and H J Bentson, United Engineers & Constructors, Inc.*

Waste or by-product fuels available in steel works constitute the principal reason for the existence of large power plants at steel mills. There is sufficient potential heat energy in these waste fuels to generate all power and steam requirements after satisfying every other practical use. Blast-furnace gas, the principal by-product fuel, presents combustion and boiler design problems that are somewhat different from those of the more common and richer fuels.

Most installations being made today are in old plants, and present difficulties of space limitation and fitting into existing steam and electric power systems. Six installations and methods of meeting difficult conditions are described.

The steel industry represents the largest industrial user of electric power. Load at the Gary steel works, for instance, is nearly 200,000 kw. It also requires large quantities of steam for operation of blast-furnace turboblow-

Directions for ordering papers on p 152

FROM THE TOP STEEL PRODUCER . . .
TO A LEADING CHEMICAL HOUSE,
A YEAST COMPANY
AND A MEAT PACKER . . .

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62 different companies, producing everything from steel to beef, have found the Heat Prover an important aid to increased production and big dollar economy.

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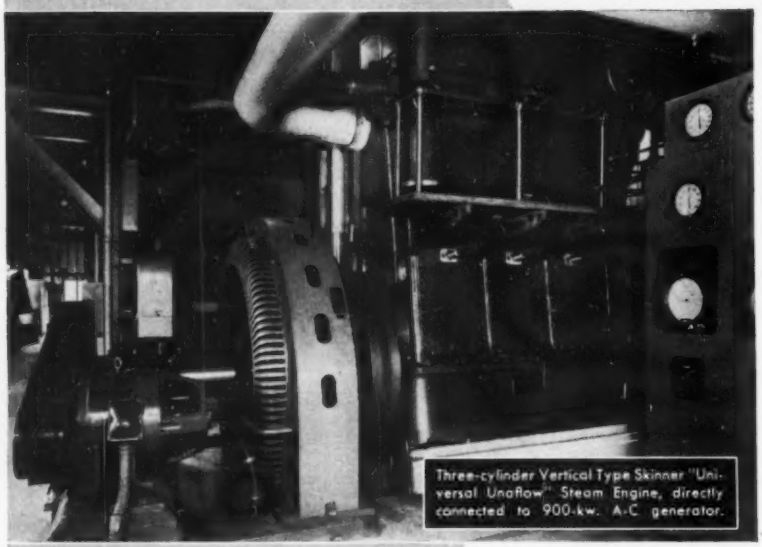

Three-cylinder Vertical Type Skinner "Universal Unaflow" Steam Engine, directly connected to 900-kw. A-C generator.

SKINNER "Universal Unaflow" STEAM ENGINE

Generates

ALL THE POWER THEY NEED... AND IT'S A BY-PRODUCT...

in this Bleachery and Dye Works

At the Great Falls Bleachery & Dye Works, Inc., Somersworth, N.H., production of steam for low-pressure processing is a necessity, and is one of the large operating costs.

Thanks to the economy of the Skinner "Universal Unaflow" Steam Engine, their electric power, instead of being a large operating cost, is obtained as a by-product of the bleaching and dyeing operations—*and at practically no cost.*

In spite of variation in power and steam requirements, the heat balance is sufficiently close so that exhaust steam is rarely wasted to atmosphere, and the engine generates all the power requirements of the mill.

The savings made to date through the installation of the Skinner Engine-generator unit indicate that the cost will be returned to the owners within three to four years. Write for case studies of what has been accomplished in industries similar to yours.

"Universal Unaflow" Steam Engines are built in horizontal types from 75 to 1200 hp.; in vertical types from 300 to 3000 hp.; and Skinner Marine Unaflow Steam Engines in capacities from 400 to 6000 hp.

For Over 80 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

More TECHNICAL BRIEFS

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ers, mill engines, various types of steam-operated mechanical equipment and miscellaneous heating and process uses. The authors discuss in detail some of the more difficult steel mill power plant problems. *ASME paper. No. 52-F-46.*

Miscellaneous

The Development of Gas Turbine Controls. *By G F Drake, Woodward Governor Co.*

This paper gives a brief historical outline of the activities of the Woodward Governor Co in gas turbine controls development, primarily those controls intended for aircraft populsion turbines.

In 1943 the Air Material Command, who knew of Woodward's background as speed governor manufacturers through their work with variable pitch propeller governors, asked them to consider a highly secret problem.

When, after a time, it was admitted that the hypothetical engine was actually a gas turbine, Woodward still didn't know what was required except that speed control was important. So they decided to start with this.

The engine limitations were being learned and new requirements set up at a rate that constantly made the current production model obsolete.

One thing soon became clear: in order to get the most out of this new engine, it should operate just below the speed where it would disintegrate and the temperature at which it would melt. With speed and temperature as the critical factors, it seemed logical to control them directly if at all possible. Stable steady-state speed control had already been accomplished, and for the simple turbo-jet without afterburner or variable tail area satisfactory steady-state temperatures automatically accompanied satisfactory steady-state speed.

Speed droop was unwanted, however. It required operation at less than maximum allowable speed to supply the fuel needed at low altitudes, and "de-drooping" at best gave an approximation of isochronous or constant speed operation. So it was decided to adopt a governor that is inherently isochronous. The author describes how the solution of each problem brought on a new one. *ASME paper. No. 52-F-23.*

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General Electric Co, will install, for early 1953 service, four gas-turbine plants for the Connecticut Electric Light & Power Co. These plants are the first turbine ones to go into service in Connecticut.

PROSPERITY in the USA: Who Has It?

How prosperous *are* the people of the United States?

The previous editorial in this series answered this question for the average American. His prosperity has increased only slightly in recent years.

But the average tells only a part, and in many ways not the most important part of the story. Which individuals and groups have prospered more, which less? (The average, the result of a statistical calculation rather than a creation of flesh and blood, tells nothing about that.)

The purpose of this message is solely to get at the facts on this question of how prosperity is distributed. This is not easy. In spite of the crucial importance of the subject, the available information is limited. Even so it is possible to provide a rough answer to the question, "Who has the prosperity?"

We Have Had a Revolution

The distribution of income in the United States has changed so greatly in the past twenty years that Arthur F. Burns, Research Director of the National Bureau of Economic Research, world renowned for its impartiality and technical competence, calls it "one of the great social revolutions of history." A part of this revolution is portrayed by the following table which shows that individual incomes are both much larger and much more evenly distributed than they were twenty years ago. Clearly, a large new middle-class has been created.

DISTRIBUTION OF REAL INCOME

Dollars of Income*	Per Cent of Families in Each Income Group	
	1929	*1951*
Under 1,000	17%	13%
1,000 – 2,000	24	15
2,000 – 3,000	24	18
3,000 – 4,000	14	18
4,000 – 5,000	6	15
5,000 – 7,500	9	14
7,500 and over	6	7
	100%	100%

*Adjusted for price changes to give the dollar its 1951 purchasing power.

Some light on why this income revolution has taken place can be found by tracing incomes to their source. Since 1929, for instance, employees have clearly made the biggest gains in total income. This can be seen in the next table. People who own their own businesses have done second best. Farmers, who are often thought to be doing handsomely indeed, have been outstripped in the income race by employees and businessmen. People whose incomes depend upon pensions, insurance policies, and other relatively fixed returns such as rent, interest and dividends have lagged far behind.

HOW REAL INCOME HAS CHANGED*

Types of Income	Percentage Change 1929 to 1951
Wages & salaries of employees.	+123%
Income of professional men & unincorporated business	+108
Farm operators' income	+56
Rental income	+1
Dividends	+2
Interest	−35

*In this and the previous table account is taken of changes in the cost of living. But adjustment for the changing tax load was not possible, as it is in the computations which follow.

The Biggest Gains

Employees have made the biggest gains in income, but the term "employees" covers a wide assortment of people—from the presidents of the biggest corporations to factory sweepers. How have different groups of employees prospered? Some indication is provided by results of a survey of salaries in 41 corporations made by Arch Patton of McKinsey and Company and recently summarized in the *Harvard Business Review*. This survey showed that between 1939 and 1950, after adjustment both for higher living costs and for higher taxes, factory and office employees made modest gains in income while management personnel suffered losses ranging from 40% to 60%.

While factory and office workers generally have made greater income gains than others, their gains have varied greatly from industry to industry. During the past five years, for example, steel workers' take-home pay (adjusted for both taxes and price changes) has increased by 22%, that of textile workers 9%, employees of general merchandise stores 4%, and that of laundry workers not at all.

What About Organization?

How have organized workers fared compared to unorganized workers? There is no round-up of facts that makes possible a direct comparison between the two. Such evidence as there is shows it is indeed an open question whether union members have done any better than others. Steel workers, for instance, who are strongly unionized are among the highly paid manufacturing workers. Farm workers are generally not unionized, and they work in one of the most competitive industries in America.

But farm workers have made income gains which far surpass those of steel workers. Real wages of farm workers increased 2½ times more than those in the steel industry between 1939 and 1952. This fact may prove nothing more than that, in a period of inflation and manpower shortage, the less skilled workers whose incomes are ordinarily low make the biggest percentage gain in income. Further support for this conclusion is found in the construction industry where real wages of unskilled labor increased 37% between 1939 and 1952, while those of skilled labor increased only 4%.

Why Most Incomes Are Higher

Prosperity, who has it? We may conclude that workers have been getting much more of it lately than managers or property owners, that unskilled wage and salary earners have made the largest gains, and that income generally is much more evenly distributed.

Where has the money come from to raise low bracket incomes? It has come partly from an increase in the total national income, but partly also from cutting down the share received by people in the highest income brackets. While the top 5% received 33.5% of the income after taxes in 1929, their share of income has now been cut about in half. For every $11 of increase in income to the lower 95% of income receivers, about $7 has come from increased production, and about $4 by taking that amount from the top 5%.

Top bracket incomes have now been cut so deeply that the possibilities of increasing the income of the rest of the people by "soaking the rich" have largely disappeared. Indeed, if all of the income after taxes of everyone earning over $25,000 in 1951 was taken away and redistributed among the remaining Americans, each person would receive only about $65.

The significance of this revolution in income distribution is clear. It is that there is only one way by which the great mass of us Americans can continue to increase our individual prosperity. This is by earning the increase through more and more efficient production. In plotting the economic course of the U.S.A. this fact is of decisive consequence.

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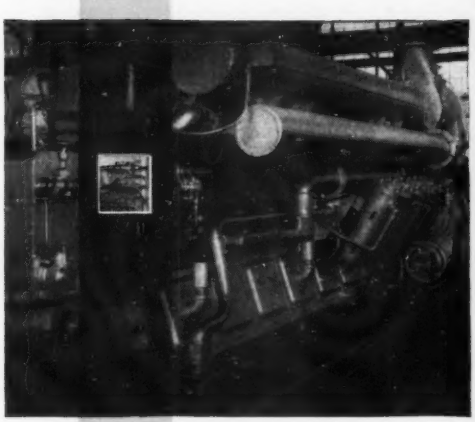
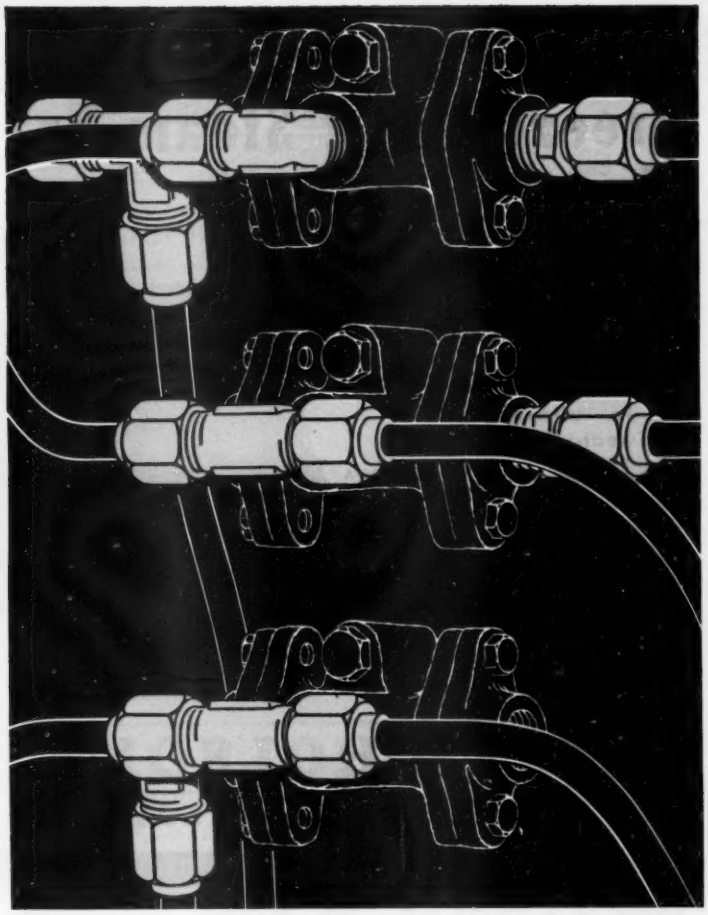
ON DIESEL ENGINES



This typical Diesel engine manufactured by The National Supply Company, Engine Division, Springfield, is equipped with Parker Triple-lok Fittings.



Tube it up...Forget it...WITH PARKER

TROUBLE-FREE TRIPLE-LOK FITTINGS

Diesel service is rugged. Constant vibration puts a severe strain on all engine parts, including fittings connecting fluid handling lines. Yet no leak, however small, can be tolerated.

That's why so many Diesel engine manufacturers rely on Parker Triple-lok Fittings . . . the fitting that meets specifications of the A.S.M.E. Code for Pressure Piping, and J.I.C. and S.A.E. standards. They are leakproof under severest conditions of vibration, elevated temperatures, high pressures and repeated assembly.

So *tube it up* and *forget it* . . . with Parker Triple-lok Fittings. Ask your Parker Distributor for Tube Fitting Catalog 4300, or write The PARKER Appliance Company, 17325 Euclid Ave., Cleveland 12, O.

This does it

Triple-lok . . . 3-piece flare fitting famous for its sleeve . . . the easiest way to install tubing systems. Made in brass, steel, stainless steel, aluminum alloy.

Precision Mark of

Leakproof Tube Fittings

Parker

TUBE FITTINGS • VALVES • O-RINGS

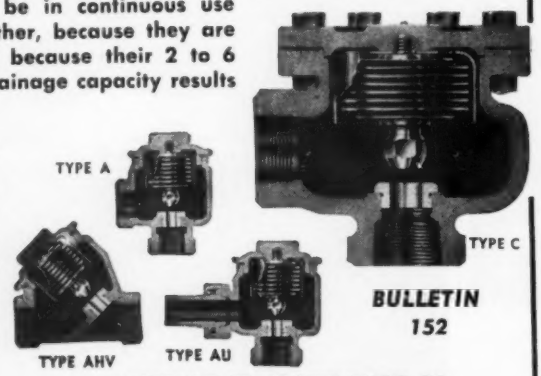
Plants in Cleveland • Los Angeles • Eaton, Ohio • Berea, Ky.

NICHOLSON MAKES

Freeze-Proof Steam Traps

for Every Plant Use

Because they drain competely when cold, these four types of Nicholson steam traps are positively freeze-proof. Can be freely installed outdoors. Universally recommended for use in lines which need not be in continuous use during cold weather, because they are freeze-proof and because their 2 to 6 times average drainage capacity results in minimum heat-up time. The non-air-binding feature of Nicholson traps also notably facilitates heat transfer in severe weather. Size ¼" to 2"; press. to 250 lbs.



BULLETIN 152

125 OREGON ST., WILKES-BARRE, PA.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

ALLPAX

...the Packing that PACKS ALL

. . . in ALL Types for ALL Services and in ALL Sizes

ALLPAX PACKINGS are available in coil, ring or loose form for general service as well as in special styles formulated for special requirements. Thus by coming to ALLPAX you can standardize on packings best adapted to your specific needs.

This universal packing that "packs all" can be depended on to stop leaks and prevent scoring. It can be used for service against steam, water, air, ammonia, oils, gases, etc. for temperatures to 6000. Special styles can be developed for higher temperatures, corrosive liquids, etc.

ALLPAX also furnishes Valve Discs, Sheet Packing, Retainer Packing, Molded and Mandrel Cut Packing Rings, Packing Hooks, Gasket Cutters.

Send for complete catalog . . . contact your nearest distributor.

THE ALLPAX COMPANY INC.

805 Mamaroneck Ave., Mamaroneck, N.Y.

Superheat Sheet Packing . . . Oil Proof Sheet Packing . . . Red Rubber Sheet Packing . . . Diaphragm Sheet Packing . . . Cloth Inserted Sheet Packing

More POWER NEWS

Begins on page 148

Coming Events

Jan 19-22—Plant Maintenance Conference, Public Auditorium, Cleveland. Advance registration, Clapp & Poliak, Inc, 341 Madison Ave, New York 17, N. Y.

Jan 19-23—American Institute of Electrical Engineers, winter general meeting, Hotel Statler, N. Y., AIEE, 33 W 39th St, New York 18, N. Y.

Jan 26-29—American Society of Heating and Ventilating Engineers, 59th Annual meeting, Conrad Hilton Hotel, Chicago. A V Hutchinson, exec secy, ASHVE, 62 Worth St, New York, N. Y.

Jan 26-30—International Heating and Ventilating Exposition, International Ampitheatre, Chicago. Auspices ASHVE. C F Roth, mgr. International Exposition Co, Grand Central Palace, N. Y. C.

March 24-27—Second Annual American Power Conference, Sherman Hotel, Chicago, Ill. R A Budenholzer, Chairman, Illinois Institute of Technology, 3300 Federal St, Chicago 16, Ill.

March 24-27—National Power Show and annual meeting National Assn of Power Engineers held in conjunction with American Power Conference, Sherman Hotel, Chicago, Ill. A F Thompson, sec, 176 W Adams St, Chicago, Ill.

April 13-15—American Society of Lubrication Engineers, annual meeting, Hotel Statler, Boston, Mass. W P Youngclaus, Jr, ASLE, 343 S Dearborn St, Chicago 4, Ill.

POWER'S History

POWER was founded in 1884 by E P Harris and H M Swetland. With it was incorporated *Steam*, which had been started by N Hawkins in Chicago two years earlier.

In 1903 POWER purchased and absorbed *Science and Industry*, which was a consolidation of a number of periodicals, namely, *Home Study Magazine*, *Home Study for Machinists*, *Mechanic's Magazine*, *Home Study for Building Trades*, *Building Trade's Magazine*, *Home Study for Electrical Workers* and *Steam Electric Magazine*.

In 1908 POWER absorbed *The Engineer's Review*, of Cleveland, and *The Engineer*, of Chicago, the latter being a consolidation of *The Safety Valve*, *Lord's Power and Machinery Magazine*, *The Stationary Engineer*, *Steam Engineering* and *The Mechanical Engineer*. When *The Engineer* was purchased, the name of the combined magazine was *Power and the Engineer*. The title was condensed to POWER in 1911. In 1951, POWER absorbed *Operating Engineer*.

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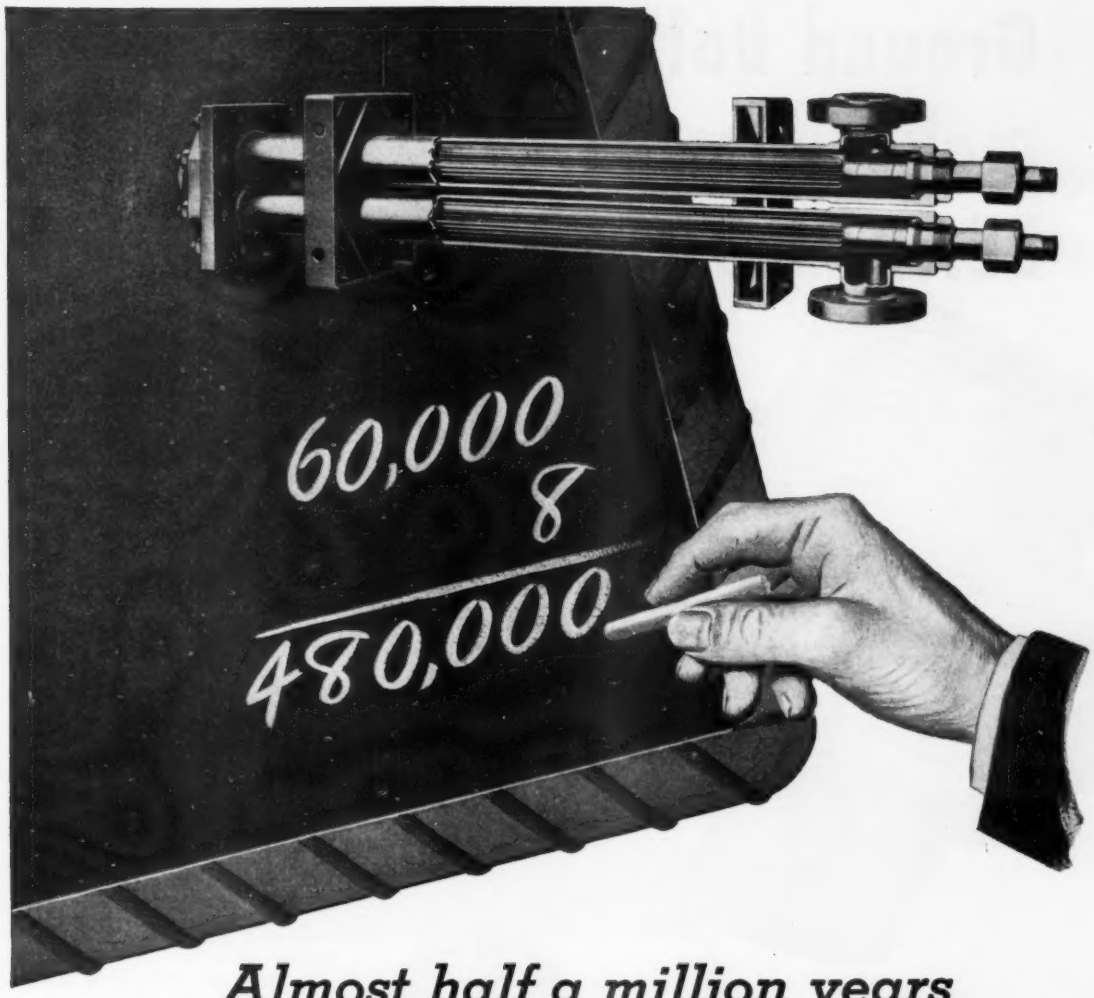


Almost half a million years of heat exchanger service!

Multiply the number of installed G-R Twin G-Fin Sections by a conservative estimate for average length of service and that's the figure you get . . . almost half a million total years of service!

Some Twin G-Fin Sections have been in continuous use for more than 20 years. And no matter what the length of service or type of heat transfer duty, here is the uniform report of users . . . effective, durable, troublefree, economical.

Twin G-Fin Sections can be used for a greater variety of services than any other design of heat transfer apparatus . . . that's one of their many advantages. Their installations include almost every type of heating, cooling, condensing, and heat exchange, and with many different liquids, gases and vapors.

Investigate the possibilities in your own plant for these time-proven standard interchangeable heat exchangers with the famous G-Fin elements. Write for bulletin, and ask about their applications to your heat transfer needs.

THE GRISCOM-RUSSELL CO., MASSILLON, OHIO

G-R *Twin G-Fin Section*

HEAT TRANSFER APPARATUS

GR 280

Ground Ball Joint makes 'em LEAKPROOF

This True Ball Joint Makes the Difference

True Ball Joint—Dart seats are spherically ground to form wide, true-bearing surfaces. Seats remain unscarred and true — always in shape for repeat use. Used over and over again — Darts stay tight without jamming.

QUICK FACTS

- 2 Bronze seats resist pitting and corrosion — provide years of leakproof service
- Heavy shoulders can withstand brutal wrenching
- Nut and body of air-refined, high test iron are practically indestructible

These Dart features mean important savings over the years for every user.

DART UNION COMPANY
Providence 5, Rhode Island
The Fairbanks Co. — Distributors
Boston·New York·Pittsburgh·Rome, Ga.

DART UNIONS

More POWER NEWS

Begins on page 148

vise the Interior Dept in its brackish and saline water research. The advisers are: Dr Robert G Sproul, president, Univ of California, Berkeley, Calif.; J J Cronin, vice-president, General Motors Corp, Detroit, Mich.; Dr Louis Koenig, director of research, Southwest Research Institute, San Antonio, Tex.; Henry J Schmitt, editor and publisher, The Aberdeen American-News, Aberdeen, S. Dak.; Dr Lee A Du Bridge, president, California Institute of Technology, Pasadena, Cal.; Dr George D Humphrey, president, Univ of Wyoming, Laramie, Wyo.; Dr Sheppard T Powell, consulting engineer, Baltimore, Md.; Dr Frederick L Horde, president, Purdue Univ, Lafayette, Ind.; Dr James R Killian, Jr, president, Massachusetts Institute of Technology, Cambridge, Mass.

Goodrich W Lineweaver, assistant commissioner of the Bureau of Reclamation, was appointed Secretary Chapman's personal representative to administer the program.

Five Year Summary of Isotope Distribution

More than 600 universities, hospitals and research laboratories in 46 states are using isotopes produced by the U S Atomic Energy Commission for medical, biological, industrial, agricultural and scientific research, medical diagnosis and treatment, the Commission states in its recent report *Isotopes—A Five Year Summary of U S Distribution*.

The report is available to the public from the Superintendent of Documents, U S Government Printing Office, Washington 25, D. C., for $1.00 per copy. A summary of isotope applications, of interest to industry, has been compiled separately as document TID-5078 and is available at the Office of Technical Services, Department of Commerce, Washington 25, D. C., for 30 cents per copy.

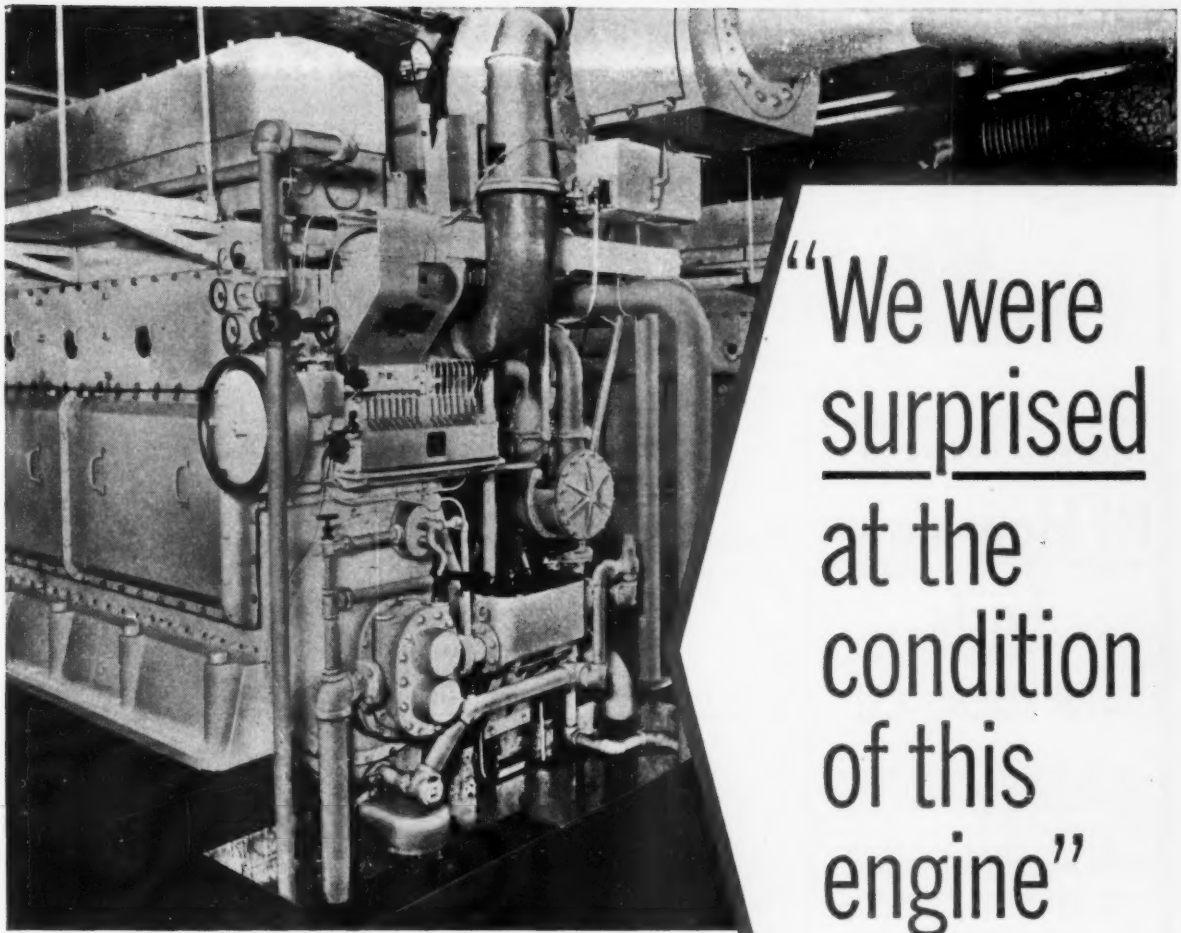
The full report shows more than 10,000 radioactive isotopes and 2,000 stable isotopes have been distributed to users in the U S and 750 radioactive isotopes to users outside of the U S.

A brief summary of the growth of the isotope program and descriptions of their uses are included in the report with a list of the users and the titles of 1,400 technical reports and papers published on isotope work in the past two years.

ASHVE Sponsors Exposition

The American Society of Heating and Ventilating Engineers, in conjunction with its 59th annual meeting (see *Coming Events*, page 202, is sponsoring the 11th International Heating and Ventilating Exposition in Chicago's International Ampitheater.

The exposition, following in logical sequence the big Centennial of Engineering in Chicago, strongly emphasizes the influ-



"We were surprised at the condition of this engine"

... says G. V. Yarger,
Supt. Municipal Utilities
Waverly, Iowa

"When we finally opened up our Worthington, it was in the *best* condition I've ever seen a diesel engine that had operated such long hours and under such heavy loads as this unit. It had a total of 48,926 hours on it – 8,987 hours of tough operation since the last overhaul.

Mr. Yarger continues, "We've been using Sinclair RUBILENE® Heavy in the crankcase and RUBILENE H.D. 30 in the cylinder lubricator. These RUBILENES have kept the crankcase and upper portions of the cylinders exceptionally clean and bright, with no sign of carbon or deposits."

That's a typical report on the exceptional qualities of the Sinclair RUBILENES ... evidence that they could improve the efficiency of *your* diesels, too. Why not switch now? Contact your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL OILS

save wear and replacements

Close-up view of leaf-type filter used with Sorbo-Cel by Pullman-Standard

How Pullman-Standard operates boilers on a

1% blow-down basis...

with SORBO-CEL

At the Haskell & Barker plant of Pullman-Standard Car Mfg. Co., Sorbo-Cel solved the major filtration problem of removing oil from condensate returned to the two new 50,000 lb-per-hr 400 psi, 750-F boilers.

Pre-Coat Sorbo-Cel and regular Sorbo-Cel, specially processed high flow-rate diatomaceous silica powders, are used on leaf-type filters. After a film of Pre-Coat Sorbo-Cel has been built up on the filter screens, regular Sorbo-Cel is added continuously to the unfiltered water. This means a new filter surface is constantly presented to the oncoming water.

Results . . . Water filtered by Sorbo-Cel contained less than 0.1 ppm of oil . . . and boilers have since been operated on a *one per cent* blow-down basis.

Send coupon below for bulletin giving data on this low-cost way to remove oil from water. No cost or obligation.

Johns-Manville
SORBO-CEL

Johns-Manville
Box 60, New York 16, N. Y. POW-1

Please send me free bulletin giving advantages of Sorbo-Cel filtration.

Name_____

Company_____

Address_____

City_____ State_____

More POWER NEWS

Begins on page 148

ence of engineering in bringing the art of air conditioning to its present great and still growing stature. Central figure among the exhibits for processing indoor climates is the display of the ASHVE itself. This depicts the Society's own research activities along engineering lines.

But the scope of the exposition is all inclusive. Complete heating, ventilating and air conditioning systems are shown as well as equipment units suitable for application in air conditioning designs of all classes. The range of applications extends from low cost dwellings htrough the entire residential field, including multiple dwellings and housing projects, to business institutions and industrial classifications.

Canadian Oil Piped Over Rocky Mts.

Now oil from the fields of western Canada, at present locked behind the Rockies, will be brought through passes in the mountains by a 700-mile pipeline from Edmonton to Vancouver, British Columbia, to be completed by the end of 1953. Construction, by Trans Mountain Oil Pipe Line Co, of the 24-in. pipeline is scheduled to start sometime in the early part of the year.

At completion, the pipeline will be able to deliver 75,000 barrels per day to Vancouver. By adding four more pumping stations to make a total of six, a capacity of 200,000 barrels per day can be achieved.

Enforcement of Illinois' new Boiler Safety Act began recently as Ben Bailey, chief Boiler inspector for the **Illinois Dept. of Public Safety,** assigned registration No. 1 to a state boiler in Springfield. Under the new act, all commercial type boilers are subject to inspection in the interest of increasing the safety of pressure vessels in the state.

Philadelphia Electric Co, is putting in the largest turbine-generator, 200,000 kw, of its kind in the world at its Phoenixville, Pa. plant, and it will bring the Cromby station capacity up to 350,000 kw.

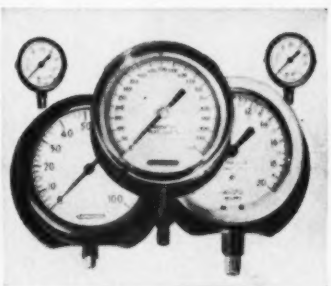
The **Boeing Airplane Co** of Seattle is building a gas turbine-electrical generator unit that will provide electrical power for a new type Navy minesweeper. Twin gas turbines are mounted side by side, with couplings to a generator in rear. First complete unit recently was delivered to John Trumpy & Sons, Annapolis, Md., builders of the new vessel.

In the 10 years since the **Fairmont Coal Bureau** was formed, approximately 1500 modern postwar installations have included the fuel flexibility sought by the bureau. Those installations, according to Carl Marshall, present director, now represent a potential market of 77 million tons of coal a year, most of it in the area regarded as Fairmont's primary market area.

FOR EVERY APPLICATION there's a

Lonergan

GAUGE

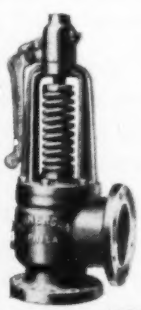


CHOOSE FROM

28 TYPES

OVER 100 MODELS

Sizes up to 12 inch offer maximum selection. All are exactingly engineered and most modern in design. Thousands of installations prove the accurate performance of these long-life gauges. Your nearest LONERGAN dealer will gladly show you the line.



A FULL LINE FOR FULL PROTECTION

LONERGAN Safety and Relief Valves for Moderate and High Pressures and Temperatures are made in a large variety of standard types. They're noted for advanced design and performance. *Ask for Catalog 800-V.*

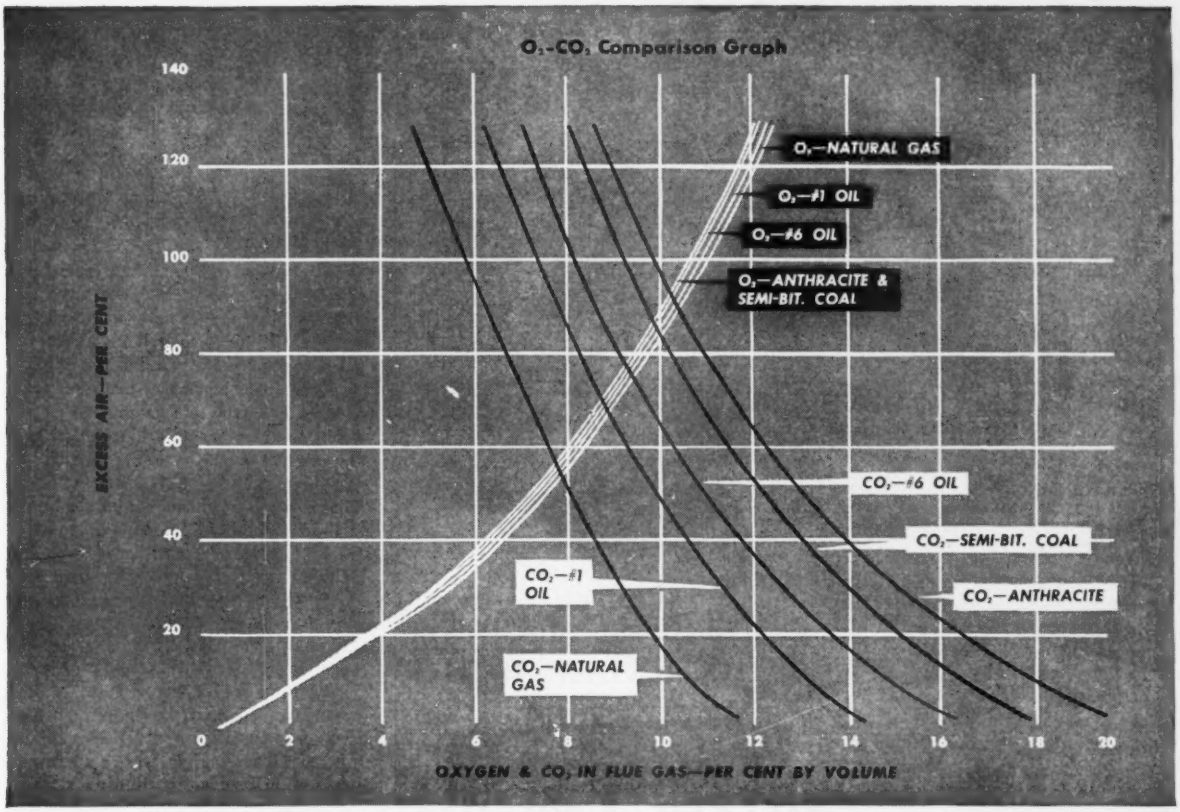
Lonergan

J. E. LONERGAN COMPANY

Race and Second Sts., Phila. 6, Pa.

Over 80 years experience

How to burn Multiple Fuels efficiently



Oxygen and Oxygen alone gives you an undistorted picture of the amount of excess air present.

When switching from one fuel to another or burning more than one fuel at the same time, you can realize large savings with a continuous indication of Oxygen content in your flue gas—because Oxygen and Oxygen alone gives you an undistorted picture of the amount of excess air present.

This fact is borne out by the graph showing the relationship of excess air to CO_2 and O_2 in the flue gas of five common fuels. While the O_2 curves nearly coincide (especially in the important 30% excess air range) the CO_2 curves diverge widely.

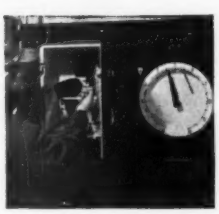
Large Savings Possible

This deviation was costing a medium sized refinery in Michigan $35-40 per day in boiler room fuel costs. Burning a combination of oil and gas they found that a combustion control system to handle their multiple fuel firing conditions would cost more than their small boilers.

They purchased a Hays Magno-Therm Oxygen Recorder, and immediately found that their boiler operation was so inefficient that the pen would not stay on the 0-10% chart. However, by operating with reference to the O_2 recorder they were able to reduce fuel costs enough *to pay for the instrument in 40 days.*

With the Hays Magno-Therm Oxygen Recorder you get:

Continuous, highly accurate indication and recording.
Complete compensation for temperature and pressure effects.
Freedom from chemicals or hazardous fuel burning in the analyzing process.
Swift, sure electronic operation.



If you are facing the problem of multiple fuel combustion, you will want a detailed copy of this O_2-CO_2 Comparison Graph as well as Hays Bulletin 50-829—describing the Magno-Therm Oxygen Recorder. Write for this free information.

THE HAYS CORPORATION
MICHIGAN CITY 3, INDIANA

Automatic Combustion Control • Boiler Panels • Hays-Penn Flowmeters
Veriflow Meters and Veritrol • Gas Analyzers • Draft Gages
Combustion Test Sets • CO_2 Recorders • Electronic Oxygen Recorders

NATIONAL AIROIL

"S-A"

TYPE STEAM ATOMIZING OIL BURNER

VIRTUALLY IMPOSSIBLE FOR ANYTHING TO CLOG OR GO WRONG . . .

. . . SEE FOR YOURSELF!

The popular NATIONAL AIROIL Steam Atomizing Oil Burner *thoroughly atomizes* and *completely burns* the lowest and cheapest grades of fuel oil or tar . . . requires only minimum supervision and maintenance. Only slight oil pressure and temperature is needed . . . and internal atomizing venturi feature assures low steam consumption . . . usually as little as 1%! NATIONAL AIROIL Type "SA" Oil Burner is adaptable to all types of industrial heating, power or process furnaces . . . is suitable for firing above stoker grates on conversion to oil.

Other "SA" modifications designed for: the burning of Colloidal fuel ("SAR")—Large capacity operation ("SAL")—Sludge burning ("SAD")—Combined steam and mechanical atomization (Dual Stage).

WRITE FOR BULLETIN 21

OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes
STEAM ATOMIZING OIL BURNERS
MOTOR-DRIVEN ROTARY OIL BURNERS
MECHANICAL PRESSURE ATOMIZING OIL BURNERS
LOW AIR PRESSURE OIL BURNERS
AUTOMATIC OIL BURNERS, for small process furnaces and heating plants
GAS BURNERS
COMBINATION GAS & OIL BURNERS
FUEL OIL HEATERS
FUEL OIL PUMPING and HEATING UNITS
FURNACE RELIEF DOORS
AIR INTAKE DOORS
OBSERVATION PORTS
SPECIAL REFRACTORY SHAPES

NATIONAL AIROIL BURNER CO., INC.

1250 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.
Southwestern Division: 2512 South Boulevard, Houston 6, Texas
INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

NEAL STATION

Continued from page 74

wg pressure, which flows through the lignite. The heated air is taken off the boiler air preheaters. Dampers in the duct help control air temperature. The closed bunkers are vented through a roof ventilator. Steam smothering lines function to put out fire.

This arrangement prevents wet coal freezing into large chunks. Temperature of delivered lignite will be as low as –20 F during the winter. The heated air also drives off combined moisture. If moisture can be reduced even by 10%, considerable saving in pulverizing power will be realized. Laboratory studies have been made, but not enough practical experience has been accumulated to evaluate this saving.

Electrical. Neal Station sends out energy at 115,000 v to the Bureau of Reclamation and at 41,600 v to the Otter Tail Power Co and the Verendrye Coop. Generation at 13,800 v steps up to 115,000 v. The 41.6-kv yard is fed from the 115,000-v yard through a transformer equipped for tap changing under load.

Station power comes directly from generator terminals. A standby source comes from the 41.6-kv yard. Regular auxiliary power is taken from a dry-type transformer in an indoor substation. All auxiliaries are 440 v. The switchyard at Neal is both a transmitting station and a distribution station. Metering and protective equipment is more complicated than is usual in a station this size.

MARMADUKE

Continued from page 142

greased the customs officials for it the trip before.

"Grogan grumbled loud and long about being 'crossed up' by the captain. 'I'll show that deck swabber that he can't monkey with an engineer,' he threatened.

"As usual Grogan had my work laid out when we pulled into port. The oilers and myself had the port engine opened up shortly after shutting down that evening. Grogan stayed around long enough to see the work started. About midnight, he had a cargo sling lower three heavy suitcases into a waiting sampan below his room, on portside.

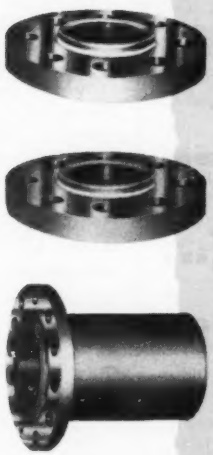
"We worked away and were ready to close up the engine a few hours before sailing, two days later. Then I discovered that a very important part of the engine was missing. We searched the engine room, the fire room and even the store rooms. We looked all through the bilges and even poked around in the coal bunkers.

"When the captain heard that we

KEY-KAST

Alloy Steel Welding Pipe FLANGES

all shapes
sizes
schedules



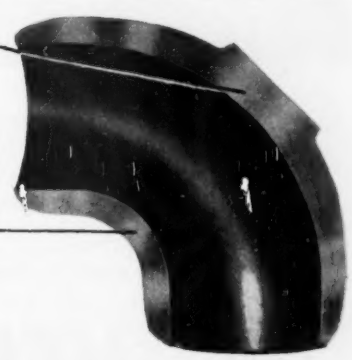
ENGINEERED FOR LONGER LIFE!

- Controlled quality . . . through rigid metallurgical control . . . produced, inspected and tested in one plant.
- A.S.M.E., A.S.T.M., A.S.A. code.
- Low and intermediate alloys and various stainless steels.
- Lower unit cost . . . plus prompt deliveries.
- Machined surface.

Key-Kast welding fittings...the strongest part of any piping system!

Greater wall thickness throughout — for increased structural strength.

Extra thickness in critical areas —for greater allowance against corrosion and erosion.



key company

Since 1916 . . . manufacturers and developers of products for high temperatures and pressures

P. O. BOX 494, EAST ST. LOUIS, ILLINOIS

DISTRICT OFFICES: NEW YORK • CLEVELAND
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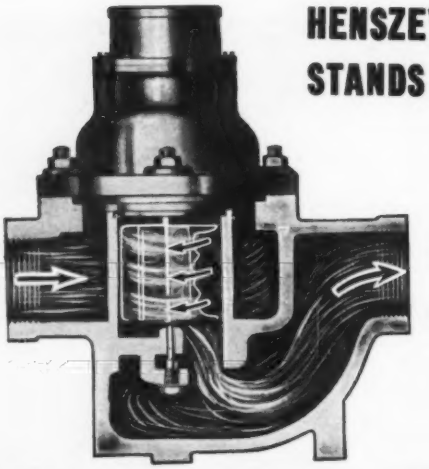


HENSZEY *Feed Water* METER STANDS UP *where others* FAIL

The cutting, abrasive action of hot, dirty Boiler Blowdown quickly breaks down meters that depend upon close clearances and intricate parts for their accuracy. Henszey Meters stay accurate—stay on the job—accurately measuring Boiler Blowdown, Feed Water, Condensate, Free-Running Chemicals and other "hard-to-measure" liquids. For details consult Sweet's Catalog or write:

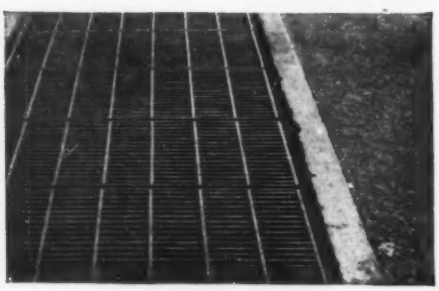
HENSZEY CO., Dept. D1, WATERTOWN, WISCONSIN

HENSZEY

FEED WATER METERS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Boiler Feed Regulators • Flow Indicators • Proportioning Valves
also MILK EVAPORATORS and PRE-HEATERS

Hendrick Heavy-duty Grating...



has wide range of usefulness

withstands weight of heaviest trucking, inside or outside of industrial plants . . . excellent for drainage applications... for coal grizzlies . . . and wherever it is necessary to sustain unusually heavy loading.

In prominent steel casting plant, Hendrick heavy-duty grating used for breakout floors has paid for itself many times over in reclaimed sand.

Bearing bars range in size from 2¼" x ⅜" to 4" x ⅜"; cross bars from 2" x 5/16" to 2½" x 5/16"; to meet requirements of loading conditions. Write for complete specifications.

SEE OUR CATALOG IN SWEET'S

HENDRICK

Manufacturing Company

Perforated Metals
Perforated Metal Screens
Wedge-Slot Screens
Architectural Grilles
Mitco Open Steel Flooring,
Shur-Site Treads, Armorgrids

46 DUNDAFF STREET, CARBONDALE, PENNA.

Sales Offices In Principal Cities

couldn't sail until that part was found. he was ready to pop his rivets. He had his mates search the ship's cargo spaces from bow to stern, but no dice. The day after sailing time we were still searching. The old man and the chief engineer threatened to log every man a week's pay if that part wasn't found by midnight.

" 'Holey Yumpin Yimminy,' bellowed the good-natured Norwegian skipper. 'How could you lose a part that weighs over two hunnert pounds—golly?'

"On the fifth day Grogan finally showed up. So did the part we were looking for. Evidently he had lugged it ashore in a suitcase.

"Grogan had shown the old man that he couldn't sail without him, but the SS *Mongolia Queen* was the last ship he sailed on in that line, and that was his last trip."

Marmaduke stopped talking and got back to his bottle.

"What part of the engine was it that Grogan lugged ashore in his suitcase?" asked an old marine engineer standing near Marmy. And it's a good thing he did, because we all stood there with open mouths, when he came to that sudden ending.

"What part," bellowed Marmy at the top of his fog horn voice, giving the poor guy a dirty look. "Why, the KNIBBLING PIN, you dumb knucklehead. What else?"

NEW LOOK

Continued from page 77

front-end loaders, back hoes, and a skylift (33-ft hydraulic scaffold). Equipment like this involves low investment costs when you figure number of jobs it can do, besides being available for emergency air supply in a unit system.

Flexibility. System capacity and piping are easily changed in unit systems. Service continuity is greater because temporary or permanent hookups between various compressors are easily made. A unit can be out of service without affecting plant air supply much.

Maintenance costs are lower because parts are smaller, readily stocked by dealers and easily obtained.

Operating Costs. Up to now we've overlooked power costs because in load-center electrical systems the only saving is in less line loss.

In air systems there is the false impression that greater efficiency of large compressors and motors reduces running costs. This may be true for large systems using full capacity at all times, but average plants don't have this type load. Even with step controls and other built-in features to save power, higher interest on investment, expensive shutdowns, and higher maintenance costs reduce large-unit savings. Today induc-

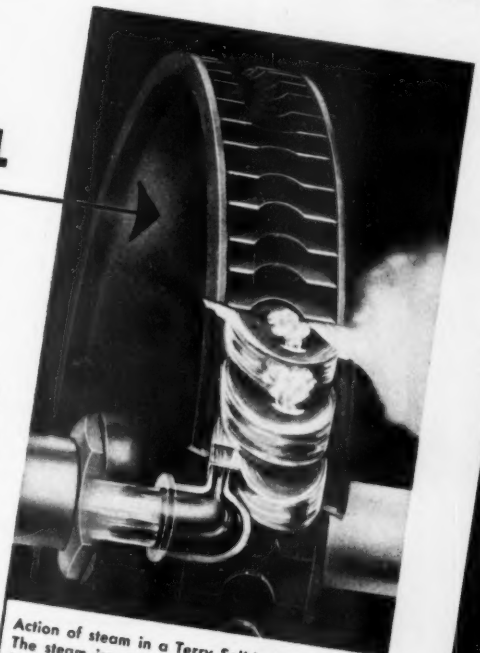
TERRY

THIS TURBINE WHEEL

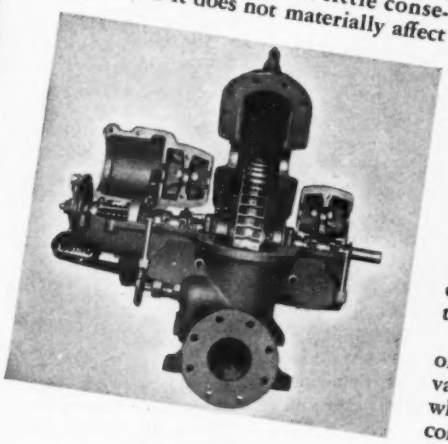
has no parts to loosen or work out

The rotor of the Terry Solid-wheel Turbine is a single forging of special composition steel, in which a series of semi-circular buckets is milled. There are no separate parts to become loose or work out.

The power-producing action of the steam takes place on the curved surfaces at the back of the buckets. Hence, wear of the blades is of little consequence, as it does not materially affect horsepower or efficiency. There is practically no end thrust since the steam enters and leaves the wheel in a direction at right angles to shaft.



Action of steam in a Terry Solid-wheel Turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket where its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized.



This is only a small part of the story of the many advantages of the Terry Solid-wheel Turbine. Write for complete details.

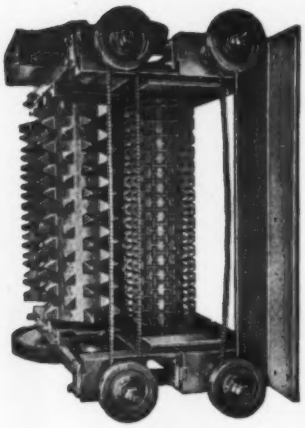
THE TERRY STEAM TURBINE CO.

TERRY SQUARE, HARTFORD 1, CONN.

TT-1189

Memo

Send for a copy of bulletin S-116 which describes the many advantages of the Terry Solid-wheel Turbine.



TWO STAGE — DOUBLE ADJUSTMENT

Crusher is pictured without hopper and sprocket guards, but is delivered complete.

WRITE TODAY FOR CRUSHER BULLETIN P-3

'Two Stage' CRUSHING IN ONE MACHINE!

The GUNDLACH *'Two Stage'* Coal Crusher incorporates two crushing stages in one machine and is designed to reduce RUN-OF-MINE to STOKER COAL in ONE operation. Compact design simplifies structural supports and installation. Rugged simple construction combined with engineering proved in the field makes this machine a profitable and reliable unit.

Fulfilling an urgent need in the industry, the GUNDLACH *'Two Stage'* Crusher has delivered over 85% usable stoker coal from an Illinois mine run lot.

All Gundlach Crushers are equipped with Gundlach Patented Crushing rollers. (Pat. No. 2578540)

MATERIAL SIZE CAN BE CHANGED WHILE MACHINE IS RUNNING

T. J. GUNDLACH Machine Co., Belleville, Ill.

NEW LOOK

Continued from page 210

tion motors for small compressors can correct power factor if fitted with capacitors.

Modern unit-type compressors are more efficient than earlier models. Force-feed lubrication with standard motor oils cuts annual costs for this job. Small floor space needed means lower "rent"; many plants now charge floor space against a machine. Smaller units are usually independent of water supplies, save on annual water bill. In unit systems one or more compressors can be shut down during periods of light load, as on night shifts.

You can't compare operating costs for "typical" plants because there are too many varying factors. But you can make an analysis before deciding on system type. Take into consideration all factors in this article.

Why do many plants still use obsolete methods for air distribution but modern load centers for electrical distribution? Perhaps the answer is that manufacturers and distributors of air compressors have not impressed on their engineers the savings possible. Since load-center and unit air-distribution systems are exactly parallel, the savings possible should be about the same for both.

STOCKPILING

Continued from page 95

age. 100 tph. Maintaining this load for 24 hr, as often happens in these days of high load factors, would mean 2400 tons of coal. Since power companies usually prefer to handle coal in one 8-hr shift during daylight hours, hourly requirement would be 300 tons. A 2-engine scraper could handle this production, by itself, for hauls up to 800 ft. For longer hauls, say up to 2500 ft, two 2-engine units could swing the job in one shift. Put another way, high production ability of the 2-engine unit appears to greatest advantage on stockpiles of over 100,000 tons requiring stockpiling or reclaiming at rates of more than 150 tph.

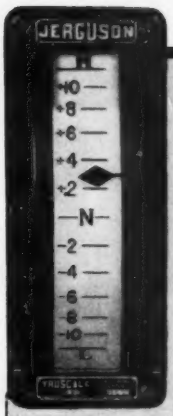
For best results using scrapers for stockpiling and reclaiming, the following practices should be followed:

1. Stockpiling area should be reasonably level and well drained.

2. If possible, pile should be laid out so it is longer than it is wide, both for better drainage and to give the long straight run needed for best scraper loading or spreading.

3. Scraper loads should be spread in uniform layers of 6 to 12 in. deep and repeatedly run over with successive loads to give full compacting.

4. Layers of coal should be laid down



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JERGUSON TRUSCALE GAGE

THE modern design JERGUSON TRUSCALE GAGE gives new accuracy for reading of liquid levels in boilers, deaerating tanks, etc.

Here is the remote reading gage which incorporates all of the newest engineering features! The Jerguson Truscale has exceptional sensitivity, with ability to register changes as small as ½ of 1% of range! The translucent dial scale is clearly lighted from behind, and is easy to read.

Available with positive alarm system. Lights and horn signal too high or too low water level.

Visible Alarm

Horn

Repeater

Available with Repeaters which repeat accurate level readings at auxiliary locations.

Marine Operators: *Special installation procedure compensates for roll and pitch of your ship.*

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PICTURES TELL THIS IMPORTANT STORY BEST!

. . . final turbine lead for 1000 F—1850 psi installation goes in. See why Kellogg handles many of the most important hi-temperature, hi-pressure systems.

Line-up . . . perfect alinement micrometer tolerances of sections weighing tons.

Check-up . . . engineers verify the proper spacing in weld grooves and fit of backing rings.

Temperature Control . . . accurately positioned thermocouples control temperature under all conditions.

The Preheat . . . induction heating at optium temperature assures crack-free weld.

First Bead . . . senior-engineer supervised . . . complete fusion, uniform backing ring penetration are "musts."

No Letdown . . . slag-free surfaces, uniform weld-metal deposits, constant temperatures on each successive layer.

Finished? . . . welding completed, yes . . . but then comes Radiographing and vital multiple hour stress relieving.

engineers have better thought. It's a fact that all of the meticulous work done in the pre-fabrication of critical alloy piping sub-assemblies can be undone through improper field assembly and welding.

now evaluates its position. Adhering over the years to the principle of close integration of basic research, engineering fabrication and construction—Kellogg believes there is no better demonstration of its value than the demand for Kellogg pre-fabrication and installation of critical electric utility piping.

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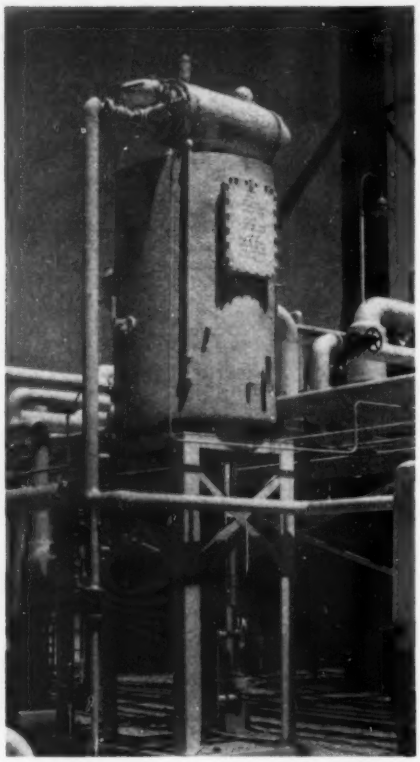
Texas Oil Refinery Solves a Feed Water Problem



CUTS BOILER REPAIRS TO MINIMUM WITH STICKLE FEED WATER HEATER

● To assure trouble-free boiler operation, this Texas oil refinery needed a dependable hourly supply of up to 50,000 pounds of preheated feed water, free of destructive oxygen and scale-forming substances. Selected for the job was the No. 6 Stickle Deaerating Feed Water Heater and Purifier, shown above.

Stickle heaters prevent corrosion of boilers, piping, steam lines and turbines by removing destructive oxygen and CO_2. Special type trays force water to flow irregularly in a thin film, depositing solids and releasing non-condensable gases. Trays cannot overflow—are easily removed for occasional cleaning. Open coils bring feed water into direct contact with steam—immediately transmit heat from steam to water—cutting fuel costs 10-15%. Condensed steam is not wasted. It provides one-sixth of boiler feed supply. Stickle feed water heaters are built in a variety of sizes. Capacities: 3,000 to 300,000 pounds per hour. Every installation is guaranteed.

Write for free 16-page Bulletin 117.

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Differential and Boiler Return Systems • Open Float Steam Traps • Regulating and Reducing Valves • Open Coil Feed Water Heaters and Purifiers • Oil and Steam Separators • Temperature Controllers

STOCKPILING

Continued from page 212

as nearly level as possible and thoroughly compacted before placing next layer.

5. Side slopes of pile, space permitting, should be kept to a maximum of 25% so scraper can descend, sealing the pile surface.

6. If space limitations require a pile of maximum height with maximum slope, then a crawler tractor with angle dozer should be used to clean up edges and seal side slopes.

7. Top of pile should have a minimum width of 50 ft for maneuvering.

8. Approach ramps are most satisfactory if they do not exceed 10%, with a practical top limit of 25%.

9. Pile should be built as close as possible to point of coal loading and unloading to minimize haul.

Reclaiming coal with a scraper is most efficiently accomplished by dumping the load directly into a drive-over hopper, but can be done in areas served by a bulldozer or a clamshell crane of some kind.

Most efficient method of loading scrapers with coal to be stockpiled is the overhead hopper, as this gives maximum pay loads. If this isn't possible, coal should be deposited by cranes or conveyors in a relatively open area so scrapers can self-load.

If more than one type of coal is to be stockpiled in the same area, different types can be segregated by either building side-by-side piles, or stockpiling in horizontal layers. Reclaiming horizontal layers is done in conventional manner, while side-by-side piles may be reclaimed by downhill loading.

Auxiliary Dozer. General operating practice on large piles uses a crawler tractor with angle dozer along with a 2-engine unit. The big machine, for safety's sake, should go no closer than one or two ft of the edge of the pile. Consequently, the angle dozer is used to dress the edges, clean up around the drive-over hoppers, and knock down high piles of loose coal to facilitate scraper loading. Some installations find their coal demand is such that six hours' production of the 2-engine scraper will handle either stockpiling or reclaiming. During the remainder of the shift, the 2-engine driver is used as a bulldozer operator, cleaning up and dressing around the pile edges.

Two-engine principle became practical with postwar development of a heavy-duty torque converter and semi-automatic transmission. Since first tests in 1946, the same power train of engine, torque converter and semi-automatic transmission has been used in scrapers and trucks, with nearly 200 of the latter

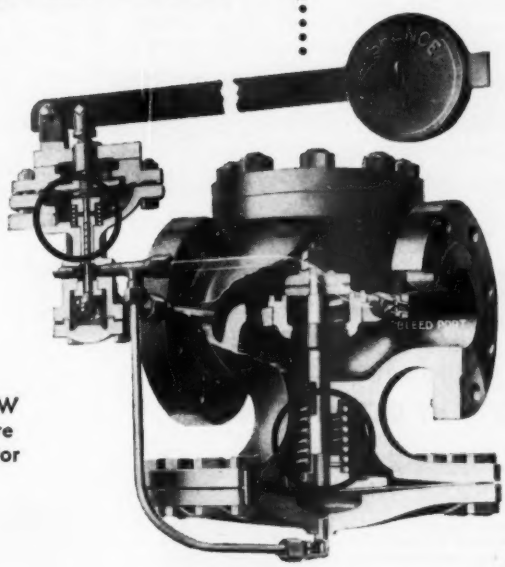
HOW SPENCE DESIGN...

...protects springs

FOR LONGER LIFE

In the Spence Regulator, the springs are out of the path of the steam or other fluid flowing through the valve. They operate at low unit stress for exceptionally long life. This is only one of the many Spence design features that assure dependable, accurate regulation year after year. That means less down-time, less time and money wasted on replacement of parts.

Spence makes a wide line of automatic regulating valves: Pressure, Temperature, Differential Pressure, Back Pressure, Pump Governor and many other types. Write for bulletin 100 giving full details.



Type EW Pressure Regulator

A few other design features:

SECO METAL SEATS AND DISCS— Durable SECO Metal resists wiredrawing. More than twenty years of experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

LARGE BALANCED METAL DIAPHRAGM located in a cooled zone with a condensate seal above and below it, never has to be replaced under normal conditions.

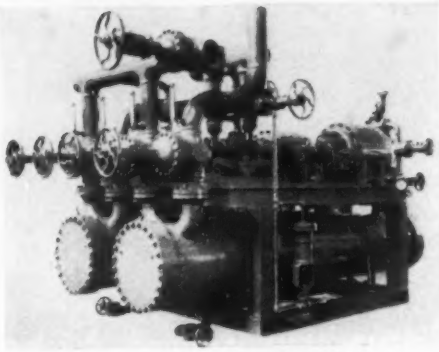
PACKLESS CONSTRUCTION—All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . reduces valve stem wear and eliminates time-consuming maintenance.

Spence

SPENCE ENGINEERING COMPANY, INC.

WALDEN, NEW YORK

LOCKETT FUEL OIL PUMPING AND HEATING SETS



The compact, high-pressure Unit illustrated here was built for a large Utility Station in the South West. It consists of two Motor-driven Pumps and two Shell - and - tube - type Oil Heaters mounted on a single frame. Each pump is designed to handle a capacity of 55,000 pounds per hour of bunker fuel oil, against 300 P.S.I.

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For almost a half century, Lockett has been supplying, to fit individual needs, efficient standard and custom-built, Fuel Oil Pumping and Heating Sets, for mechanical and steam atomizing oil burners. Combinations of various types of pumps are available: Either two Turbine-driven Pumps; one Electric-driven and one Turbine-driven Rotary Pump; two Electric-driven Rotary Pumps; two Worthington Duplex St am Pumps; or one Duplex Steam Pump and one Electric-driven Pump. Each pump-and-heater is suitable for the full rated capacity of the unit; the second pump and heater are spares. Lockett supplies everything, complete. Inquiries are invited. *Descriptive bulletins sent on request.*

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Contracting Mechanical Engineers
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RAYMASTER LEAK DETECTOR!

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DETECT Surface Condenser LEAKS and SAVE up to 80% of DOWN-TIME!

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STOCKPILING

Continued from page 214

being used in the Minnesota iron ranges.

Use of two engines in one machine offers these advantages: (1) large tonnage rating with power and drive components of a smaller unit (2) use of two relatively low-cost engines to obtain power of a single large engine (3) powering of widely separated drive axles for maximum machine traction without need for a long mechanical drive. Both engines are under complete control of the operator. They can be used separately or in unison to provide self-loading or rapid acceleration over difficult haul conditions.

Costs. For comparison, Table II shows hourly estimated ownership and operating costs for a 2-engine scraper in industrial coal stockpiling and reclaiming. Accurate cost records from the original coal-handling installation, which has operated for more than 5000 hr, verify these estimates. Complete parts and labor cost for maintenance and repair have been under $1.00 per hr. Original tires and cutting edges are still in use.

To check original production estimates for specific operating conditions, a large southern Ohio power company conducted tests with a 2-engine unit. Original estimates and actual test results were as follows:

Estimated production		*Actual results*	
1470 ft*	370 tph		
1820 ft	270 tph	1835 ft	285.8 tph
2300 ft	250 tph	1915 ft	304.0 tph
2720 ft	229 tph	2010 ft	304.5 tph

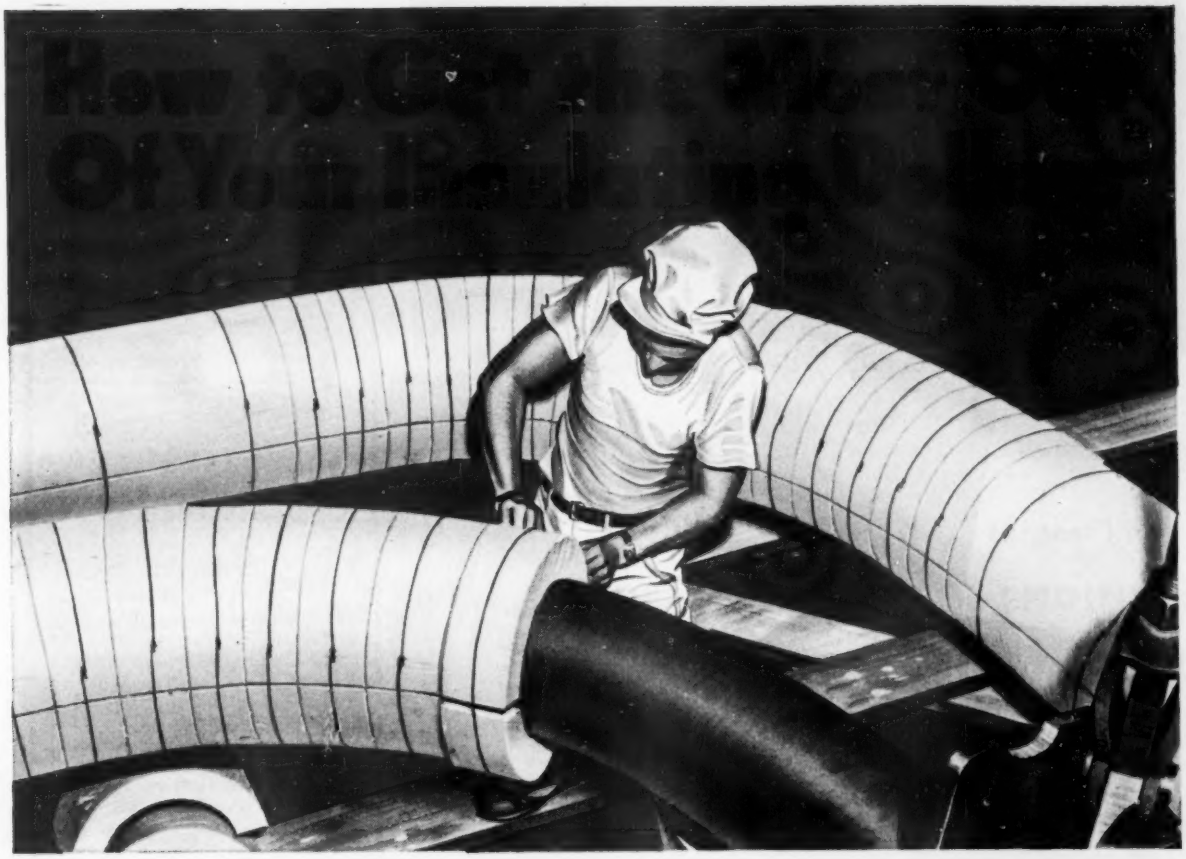
*All distances for round trip

STRUCTURAL SUPPORT

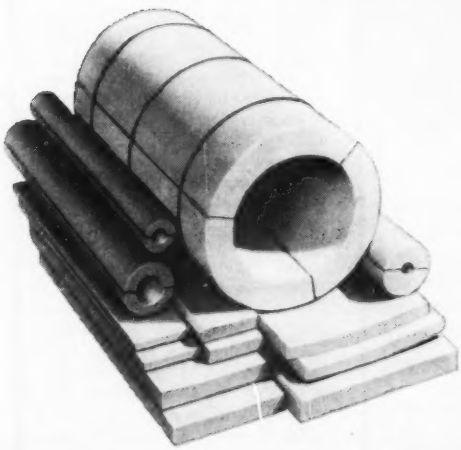
Continued from page 83

A feature of one type of standard plant is the turbine-supporting condenser. This condenser actually becomes the turbine-generator foundation. No other support is needed. With the usual concrete foundation, say for a 60,000-kv condensing machine, the space required between turbine setting on operating floor and basement floor runs to 30 to 35 ft. This allows enough space for condenser neck, condenser and hotwell.

But by making condenser a part of structural foundation, this 30 to 35 ft distance can often be cut by about 10 ft. And since height of total plant is usually governed by height of operating floor, we can cut over-all height of the building by an equal amount.



The Right Material... Expert Application



First, Kaylo Heat Insulation is *proved* a *better* material—hydrous calcium silicate. Its light weight, strength, water-insolubility, low conductivity and wide temperature range give you extra advantages *at no extra cost.*

Second, Kaylo distributors have the technical knowledge and experience to provide you with a complete insulating service. Their trained applicators are skilled craftsmen who do neat and efficient installation.

To be *sure* of getting the most out of your insulating dollars for your next job, call the nearest Kaylo distributor. Chances are you can find him listed in the yellow pages of your phone book. If not contact us and we'll give you his name.

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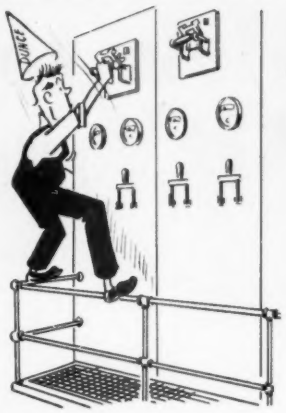


My Biggest Boner

► I'VE BEEN A SHORTY all my life—elevator shoes or not. Though you may not realize it, being short can get you into trouble in a power plant. That is, if you forget you're short.

In our industrial plant we generate electricity and process steam. About a year ago we started a plant expansion program that made excavation alongside our engine room necessary. You might not see any relation between being short and excavation for a new building but here's how the trouble popped.

Every time the excavating machinery took a bite our building shook. I was on watch in the engine room and was just making a log entry, when the building gave an awful shake. Next thing I knew all the lights began to dim.

I was in a far corner of the engine room when the lights began to go. I ran to the switchboard and saw that the field breaker on one of the two machines running had popped. I reached up and tried to close it. But it was no go. Getting panicky, I jumped onto the switchboard railing and jammed the breaker closed. I got a leakage shock that almost knocked me off the rail.

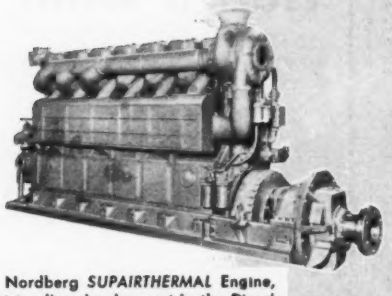
The lights went on, and I got down, thankful to be still alive. Ever since then I've mentally reviewed jobs that could get me into trouble because I'm a shorty. I tell men who wear eyeglasses or have physical defects to do the same. It's just common sense.

JACK BENNER *Chicago, Ill.*

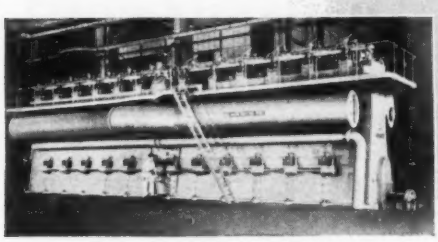
• What is your "biggest boner"? We'll pay ten dollars for each one we publish.

FOR THE BEST SOLUTION TO YOUR POWER PROBLEMS...

LOOK TO NORDBERG



The Nordberg *SUPAIRTHERMAL* Engine, —outstanding development in the Diesel field, is available in a complete range of 4-cycle types for all applications, in sizes from 535 to 4270 H.P.—including Diesel, Duafuel, or spark fired gas operation.

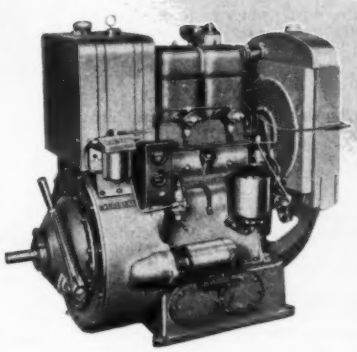


Nordberg 2-cycle Diesels for Marine or stationary service are built in a wide range of types and sizes, from 1570 to 10,800 H.P.

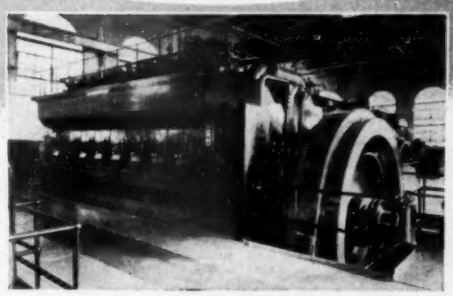
—builders of America's largest line of

HEAVY DUTY DIESEL ENGINES—

10 TO MORE THAN 10,000 HORSEPOWER



Nordberg "Packaged" Diesel Power Units —from 10 to 45 H.P., 6 to 30 K.W., for generating electricity, pumping, and straight power applications.



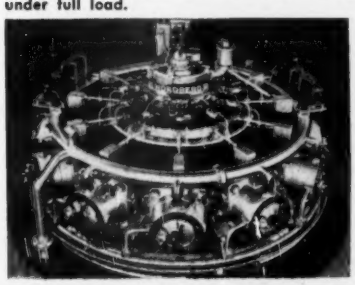
Nordberg 2-cycle Duafuel engines are built in a wide range of sizes from 1570 H.P. upward — all of which burn oil, gas, or any combination of both — and are instantaneously convertible from one fuel to another, under full load.

IN the complete line of Nordberg two and four-cycle oil burning and Duafuel Diesels and gas burning engines, you will find the right size and type of unit to meet your power requirements.

From the smallest to the largest engine, every Nordberg unit is built to deliver low-cost, dependable power . . . and the basic dependability of Nordberg engines has been amply proved in service on hundreds of successful stationary and marine power applications all over the world.

If you're planning on adding to your present power capacity, or providing new power facilities, it will pay you to investigate the long life and dependable service you get with Nordberg Engines. Write for further details, outlining your power requirements.

NORDBERG MFG. CO., Milwaukee, Wisconsin



Nordberg 2-cycle Radial engines develop 1950 to 2125 H.P. or 1250 to 1500 K.W. at 400 R.P.M., as an oil burning Diesel, as a gas engine, and as a Duafuel engine.

P-SHM152-R

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10. Economy?

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COPPER SULPHATE will control about 90% of the micro-organisms normally encountered in water treatment plants more economically than any other chemical. Very effective for taste and odor control.

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More FREE BULLETINS

Begins on page 163

15 CABLE BOXES—For plain splicing, interconnecting, sectionalizing insulated cable circuit with links or fuses. Bulletin BA52, 16 pages, illustrated. G & W Electric Specialty Co, 7780 Dante Ave, Chicago 19, Ill.

16 MINERAL INSULATED WIRING—Conductors spaced, insulated with non-combustable mineral, cased in seamless metallic tube. 24-page booklet gives history, explanation, applications. Illustrated. General Cable Corp, 420 Lexington Ave, New York 17, N. Y.

17 POWER FOR MINES — Electric power distribution and protection for open-pit mines and quarries. Photos, schematics. Booklet B-5447, 39 pages. Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

18 ELECTRONIC SUPPLIES — 224-page catalog 53 gives complete listing of electronic parts, equipment, accessories. Over 30,000 products. Radio Shack Corp, 167 Washington St, Boston 8, Mass.

19 MOTOR - GENERATOR SETS — Shunt or compound wound, ¾ to 1,000 kw. Bulletin F-2502, 4 pages, illustrated. Reliance Electric & Engineering Co, 1088 Ivanhoe Rd, Cleveland 10, Ohio

20 COPPER OXIDE RECTIFIER STACKS — Gives characteristics, applications, has charts, graphs, tables, circuit design. Booklet GEA-5699A, 8 pages. General Electric Co, Schenectady 5, N. Y.

21 AUDIO SYSTEMS—Electronically amplified voice communication for plants. Bulletin 26, 4 pages, illustrated. Farmers Engrg & Mfg Co, Irwin, Pa.

22 POWER FOR STEEL — Reviews development, applications, advances in electric power to steel industry. Booklet B-5443, 35 pages, illustrated. Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

23 INSULATION—Class B composit insulation. Is saturated asbestos paper, varnished open-weave fiberglas covering. 4 pages, illustrated. Natvar Corp, Randolph Ave, Woodbridge, N. J.

24 AUTOMATIC VOLTAGE STABILIZERS—From 15 to 5,000 v. Photos, diagrams, operating principles, construction, complete specifications. Booklet GEA-5754. General Electric Co, Schenectady 5, N. Y.

25 CHEMICAL PROCESSING EQUIPMENT—Catalogues, describes electrical equipment for chemical processing. Power generation, distribution, utilization. B-5656, 15 pages, illustrated. Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

26 VERTICAL MOTORS — For deep well turbine pumps, 1½ to 400 hp. Full color illustrations, 16 pages. U S Electrical Motors, Inc, Box 2058, Los Angeles 54, Calif.

27 RECTIFIER BULBS—Description, operation, circuits, ratings, etc, of ac to dc bulbs. Booklet GEA-5677, 8 pages. General Electric Co, Schenectady 5, N. Y.

28 DISTRIBUTION AND CONTROL—Catalog digest is abridged listing of product range. No. 135, 108 pages. Square D Co, 6060 Rivard St, Detroit 11, Mich.

29 DRY - TYPE TRANSFORMERS — For industrial control. Graphs, tables, circuit diagrams. Bulletin T-5111, 8 pages, illustrated. Hevi Duty Electric Co, Milwaukee 1, Wis.

30 GEAR MOTORS—Ac and dc single reduction, 1 to 30 hp, polyphase; 1 to 15 hp dc. Bulletin 3600-H-1, 4 pages, illustrated. Westinghouse Electric Corp, Nuttall Plant, Gearing Div, Pittsburgh, Pa.

31 CIRCUIT BREAKERS—Operating principles, application engineering data, simplified diagrams. Manual 101, 16 pages, color illustrated. Heinemann

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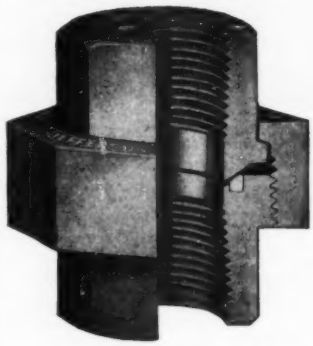

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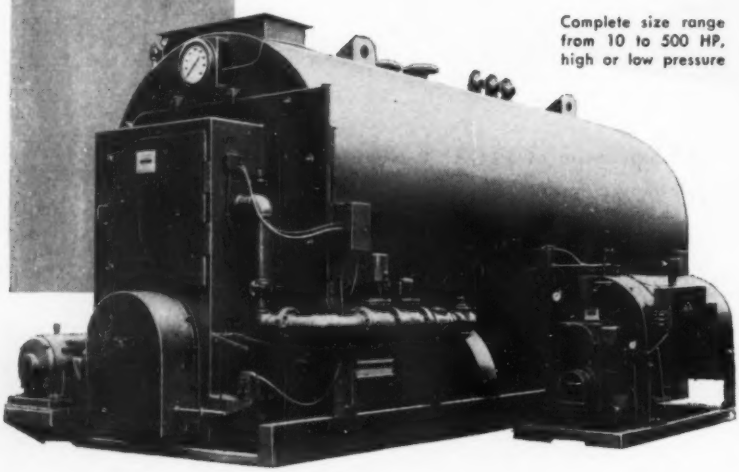
3 you save three ways on steam with Continental AUTOMATIC BOILERS

. . . installation, fuel and maintenance!



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Electric Co, Trenton 2, New Jersey.

32 MOTOR SELECTOR—Pocket-sized slide rule selects motor rating from 1/2000 to ½ hp. Howard Industries, Inc, Racine, Wis.

33 RELAYS — Automatic and hermetically sealed telephone-type relays for industrial control. Circular 1702-A, 12 pages, illustrated. Automatic Electric Co, 1033 W Van Buren St, Chicago 7, Ill.

HEAT EXCHANGERS

34 VAPOR CONDENSER — Standard vertical thermosyphon reboiler and reflux condenser. Specifications, 4 pages. Doyle & Roth Mfg Co, Inc. 136-50 Twenty-Fourth St, Brooklyn 32, N. Y.

35 SURFACE CONDENSERS — Cutaway views of design, construction, steam, air and water flow. Booklet B-4350, 32 pages, illustrated. Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

36 HEAT EXCHANGER TUBES—Description, application, specifications and data. 24 pages, illustrated. Aluminum Co of America, Gulf Bldg, Pittsburgh 19, Pa.

37 STEAM TRAPS — Discussion of relation of vacuum to steam trap performance. Diagrams, charts, examples. 4 pages. Armstrong Machine Works, Three Rivers, Mich.

INSULATION, HEAT, COLD

38 STUD WELDING — Construction application data and specifications for securing insulation. 35 pages. Nelson Stud Welding Div, Gregory Industries, Inc, Lorain, Ohio

39 HOT, COLD PIPING—Insulation made from glass fibers bonded with thermal-setting plastic resin. Properties, specifications, application description. 16 pages, illustrated. Gustin-Bacon Mfg Co, 210 W 10th St, Kansas City, Mo.

40 EXPANSION JOINT DESIGN GUIDE—Basic theory and catalog of line. Specifications and installation information. 16 pages, illustrated. Flexonics Corp, 1301 S Third Ave, Heywood, Ill.

MAINTENANCE AND SAFETY MATERIALS AND EQUIPMENT

41 COUPLING MANUAL — Maintenance on disconnecting hydraulic couplings. Bulletin 500, 12 pages, illustrated. Twin Disc Clutch Co, Hydraulic Div, Rockford, Ill.

42 WHEEL-TRACTOR MAINTENANCE—Dialog treatment covers preventative maintenance for models DW21, DW20, DW10. Form 30275, 24 pages in color. Caterpillar Tractor Co, Peoria 8, Ill.

43 WIRE FENCE COATING—Roller method applies rust preventive coat to wire fences. Form 120, 6 pages. Rust-Oleum Corp, 2799 Oakton St, Evanston, Ill.

44 CRANE SIGNALS CHART — Wall chart pictures crane control signals and proper use of slings. Chart 5237, 11x14 in. Macwhyte Co, Sling Dept, Kenosha, Wis.

45 SAFETY EQUIPMENT — Tools, clothing, instruments, materials for safety. Catalog 100, 145 pages, illustrated. The Boyer-Campbell Co, 6540 St. Antoine St, Detroit 2, Mich.

46 OIL FILTRATION—And handling systems for industry. Bulletin 4J-Ho, 4 pages, illustrated, examples. Honan-Crane Corp, Lebanon, Ind.

47 LIQUID POLYMER—For patching, impregnation, caulking, sealing, binding and as protective coating. 4 pages, examples, illustrated. Thiokol Corp, Trenton 7, N. J.

48 TEMPERATURE LIQUIDS — Supplementary instruction sheet for using temperature sensitive liquid. 1

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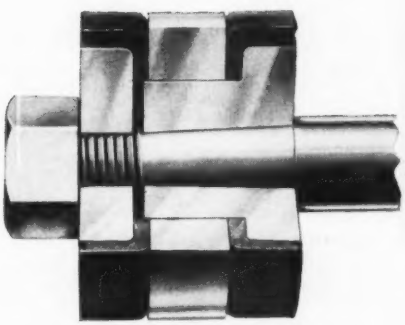
GARLOCK MOLDED CUPS

For Pump Pistons, Hydraulic Service, Pneumatic Equipment

A COMPLETE LINE OF CUPS FOR INDUSTRIAL USE



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GARLOCK Molded Packing Cups are made from the highest grade materials to rigid specifications for *long, trouble-free service.* These cups are made in many types and styles, each designed and constructed for a specific service condition.

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Rubber and Synthetic Rubber Cups with fabric insertion are made in a wide range of material combinations for cylinder diameters from less than ½" up to and including 16". For service against air at high or low pressures, against oils, and on heavy duty hydraulic equipment.

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GARLOCK

**PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS,
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Specify VIKING For Your Future PUMP PLANS

Check today on your pumping equipment needs. Viking offers the most complete line in the rotary pump field. The range of sizes and styles are the largest available.

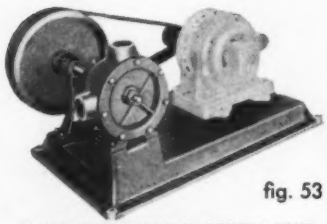

fig. 53

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Each is built to handle the specific job. Outstanding features includes fast self priming . . . smooth, even discharge . . . low power requirements . . . compact and rugged construction.

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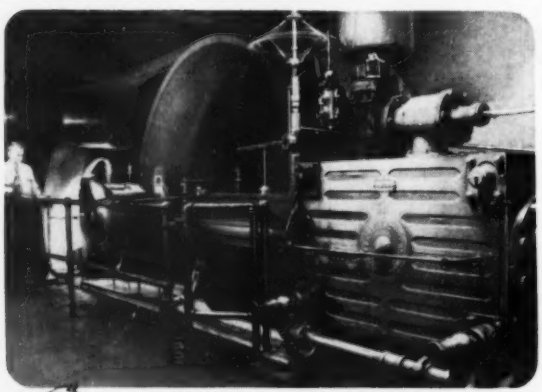
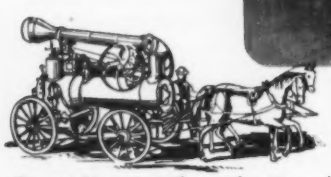
Viking PUMP COMPANY Cedar Falls Iowa

DEMONSTRATING THE DEPENDABILITY OF FRICK EQUIPMENT





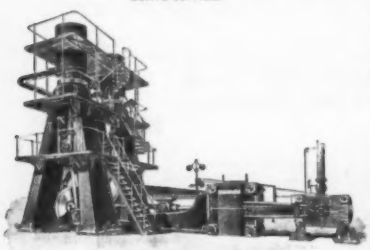
This portable engine still runs after 72 years' active service.

The portable steam engine shown at left was operated in Virginia from 1872 to 1949: the Corliss type above, built in 1891, is still running at Irwin, Penna.

Another Frick Corliss, shipped in 1888, is still going strong at Weldon, N. C.

Frick Company was established a century ago for making engines and farm machinery. For over 70 years it has pioneered in building refrigerating and air conditioning systems. Frick compressors commonly achieve service records of 40 years; many have run 50; some even 60!

The whole story of Frick equipment is told, with 200 illustrations, in the Centennial History just published: send $1 for your copy. And get estimates now on the cooling system you need.



The largest Frick refrigerating machine ever built (1896), was 50 ft. long; in service for Armour 40 years.

DEPENDABLE REFRIGERATION SINCE 1852

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Also Builders of Power Farming and Sawmill Machinery

More FREE BULLETINS

Begins on page 163

page. Tempil Corp, 11 W 25th St, N. Y. 10, N. Y.

49 **MACHINE TOOLS**—88-page Catalog 5205 shows line of lathes, shapers and drill presses, attachments, chucks, tools and accessories. South Bend Lathe Works, 425 E Madison St, South Bend 22, Ind.

50 **RESURFACER**—For patching, restoring damaged surfaces in concrete, stone, brick, etc. Over the Rough Spots, 48 pages. Stonehard Co, 1306 Spring Garden St, Philadelphia 23, Pa.

51 **LIQUID FILTERS**—Specifications, performance data, photos, descriptions, recommendations of type. Bulletin D-IL, 12 pages. Dollinger Corp, 11 Centre Park, Rochester 3, N Y.

52 **TUBE ROLLERS**—For expanding and rolling tubes into tubesheets. Bulletin TX-50, 4 pages, illustrated. Vernon Tool Co, Ltd, 1101 Meridian Ave, Alhambra, Calif.

53 **SMALL HOLE GRINDER** — Will convert to external grinding by interchanging wheelheads. Catalog 84A. Rivett Lathe & Grinder, Inc, Brighton 35, Mass.

54 **GRAVITY-FEED OILER** — Large capacity oiler, 9 oz to 1 gal, needle valve control. Bulletin 61-11, 1 page. Oil-Rite Corp, 2318 Waldo Blvd, Manitowoc, Wis.

55 **TUBE EXPANDERS** — 8 - page folder gives catalog samplings of cutters and expanders. Anniversary folder. The Gustav Wiedeke Co, Dayton 1, Ohio

56 **STORY OF SAFETY** — Industrial safety program at Du Pont for greatest worker protection possible. 98 pages, illustrated. E I du Pont de Nemours & Co, Inc, Public Relations Dept, Wilmington 98, Del.

MAINTENANCE MATERIALS

57 **ALUMINUM SCAFFOLD**—Rolling scaffold can be carried, erected, dismantled. Bulletin ASF-1, 4 pages, illustrated. The Patent Scaffolding Co, Inc, 38-21 12th St, Long Island City 1, N. Y.

58 **CORK** — Structure, composition, characteristics of natural cork, corkboard, compositions. Bulletin 1h-Do, 4 pages, illustrated. Dodge Cork Co, Inc, Lancaster 19, Pa.

59 **BELT LACING**—Separable fasteners with hinges for belts to 96 in. wide, ⅝ in. thick. Bulletin A-70, 2 pages. Flexible Steel Lacing Co, 4607 Lexington St, Chicago 44, Ill.

60 **SWEEPER** — Motorized sweeper with dual brushes in tandem rotating in opposite directions. 4 pages. The Motor-Mower Co, 4600 Woodward Ave, Detroit, Mich.

61 **LEAK DETECTION**—Uses glowing liquid excited by black light from portable lamp. 4 pages. George W Gates & Co, Hempstead Turnpike & Lucille Ave, Franklin Square, L. I., N. Y.

62 **CEMENT FLOORING**—8-page bulletin describes procedure of method for dense floors. Photos, examples. Kalman Floor Co, Inc, 110 E 42nd St, New York 17, N. Y.

63 **PACKINGS**—Self lubricating, sheet and teflon packings described. Catalog PC-102, 16 pages, illustrated. Greene, Tweed & Co, North Wales, Pa.

MATERIALS HANDLING

64 **PNEUMATIC TRANSPORT SYSTEMS**—Transport pumps, air-activated containers, air conveyors. Bulletin 52-F, 20 pages, illustrated. Kennedy-Van Saun Mfg & Engrg Corp, 2 Park Ave, New York 16, N. Y.

65 **INDUSTRIAL TRUCKS** — Electric power lift trucks. Photos, drawings specifications. Catalog 34, 18 pages. Lewis Shepard Products, Inc, Dept L-60, Watertown 72, Mass.

how Johnson temperature control *Automatically* attracts store traffic

Modern merchandisers recognize customer comfort as a key requirement in attracting maximum store traffic, the lifeblood of department store selling. Providing comfortable temperatures, for example, definitely helps bolster store traffic—and sales. In busy metropolitan areas, where downtown stores must compete with new suburban shopping centers, customer comfort is a "must".

Scruggs-Vandervoort-Barney, Inc., is prominent on the growing roster of leading department stores that depend on modern Johnson Automatic Temperature and Air Conditioning Control to provide the ultimate in customer comfort.

With Johnson Control in command, heating, ventilating and cooling are under complete and precise control at all times. As patrons move from floor to floor or from section to section, uniform temperatures assure the best possible shopping atmosphere. When conditions demand, it is perfectly possible to cool a crowded interior section while perimeter areas of the same floor are being heated.

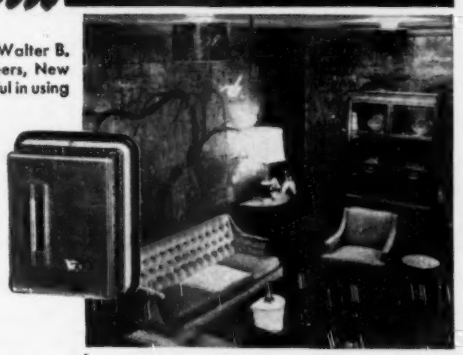
This accuracy and flexibility are typical of "Planned-for-the-Purpose" Johnson Control because each Johnson system *is specifically designed to meet the needs of the individual control problem.* That is why you will find Johnson Control not only in outstanding department stores, but in every other kind of public, business and industrial building.

Take advantage of this efficient approach on *your own* temperature control problems. The experience of the nationwide Johnson organization is at your disposal without obligation. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

Scruggs-Vandervoort-Barney, Inc., a leading St. Louis department store. Completely air conditioned, this modern store has all-year comfort control by Johnson.

"Johnson Control, a super-brain that no number of men could equal, keeps our temperatures uniform from the basement to the 8th floor," says Coy C. Leach, the store's Chief Engineer. "The system is unusually efficient, and there is a minimum of maintenance. Fuel savings are impressive, too."

Over 150 thermostats, 60 humidostats, 750 valves, and nearly 1,000 other items of Johnson apparatus operate as one efficient control system—and it's all automatic! From this panel in the machine room, 4 zone-control switches position all thermostats throughout the store for heating, cooling or ventilation.

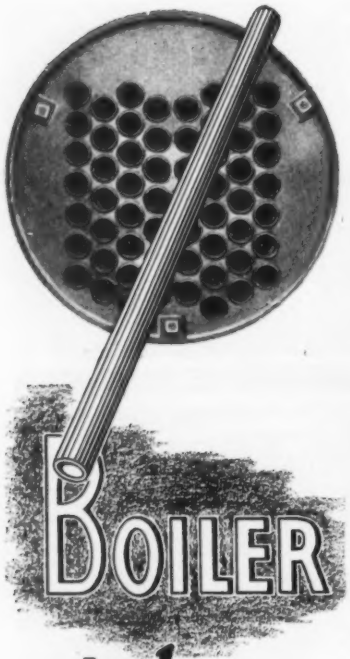


Mr. Leo S. Weil and Mr. Walter B. Moses, mechanical engineers, New Orleans, La., were successful in using a minimum of valuable floor space throughout the store in planning this installation nearly 40 years after the store was built. Sodemann Heat and Power Co., St. Louis, Mo., were the mechanical contractors.

YOU, TOO, may be interested in a store, hotel, hospital, school, factory or office building. Let a nearby JOHNSON engineer help you solve your control problems on any new or existing building, regardless of size.

JOHNSON *Automatic Temperature and Air Conditioning* **CONTROL**

MANUFACTURE • APPLICATION • INSTALLATION • SINCE 1885



tubes

Uniform strength, accurate dimensions and high ductility are three of the many qualities found in Murray boiler tubes. Welded or seamless tubes in sizes ranging from ⅝- to 8-inch OD are available for immediate shipment from warehouse stocks.

If you have a tubing problem, the experience of our specialists and the research facilities of our suppliers are at your service.

WRITE FOR CURRENT TUBE STOCK BULLETIN

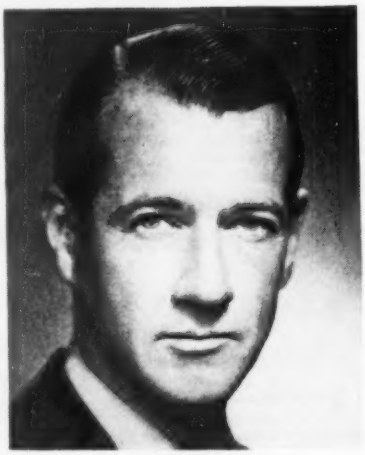
Other Murray products include carbon and stainless steel tubing and pipe for pressure and mechanical purposes; welding and screw type pipe and tube fittings. Tube bending, upsetting, swaging.

7251

A B MURRAY CO INC
ESTABLISHED 1845
ELIZABETH, N. J. McKEESPORT, PA.

APPOINTMENTS

New Corporation Executives



Malcolm Smith

Malcolm Smith is elected to a newly created board of directors seat by the **Byron Jackson Co.** Smith, formerly a partner of J H Whitney & Co, is also a director of the Spencer Chemical Co and The Vendo Co.

Allis-Chalmers Mfg Co names J D Greensward vice-president, director of manufacturing, general machinery division, to replace Fred Mackey who resigned. Previously Greensward was general manager of the firm's Norwood, Ohio, Works.

C Robert Maranville, formerly assistant to the works manager of the Holyoke, Mass, plant of **Worthington Corp,** is elected assistant treasurer of the corporation. **W K Mitchell Co** elected George L Huber to the presidency succeeding the late H A Bissout, who died September 16.

Dr E W Reid, president of the Corn Products Refining Co and recipient of the 1951 Chemical Industry Medal, is elected a director of the **American Locomotive Co.** Dr Reid was formerly Chief of the Chemical Section of the War Production Board and later was named Deputy General Director of WPB.

Rohm & Haas Co has elected Donald F Murphy a vice-president. Harry T Kessler has been made president and treasurer of the **Tuthill Pump Co,** and N G Tuthill was elected vice-president and secretary. E D Tull is named to the newly created post of vice-president and general manager of **Cummins Engine Co, Inc.**

New Operations Executives

Westinghouse Electric Corp names T J Newcomb as manager of the company's Television-Radio Div. He succeeds F M Sloan, who becomes manager of operations for that division.

Robert P Liversidge was elected vice-president in charge of operations for **Philadelphia Electric Co.** Karl E Johnson, formerly Chicago district sales manager, is named to succeed Raymond C. Kelly as manager of **J F Pritchard & Co's** Equip-

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my NEW address will be . . .
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City _____ Zone____
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My OLD address was . . .
Street _____
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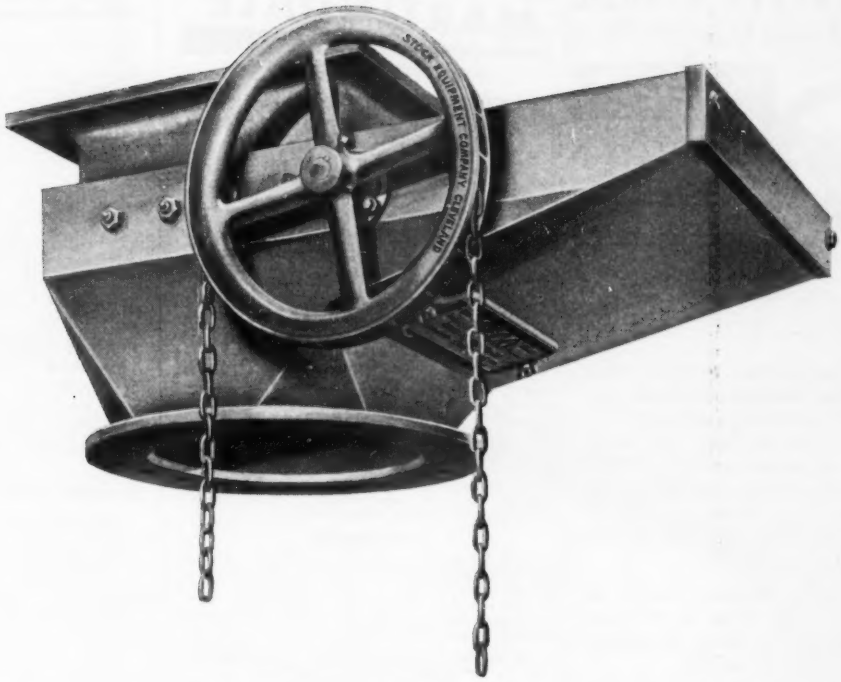
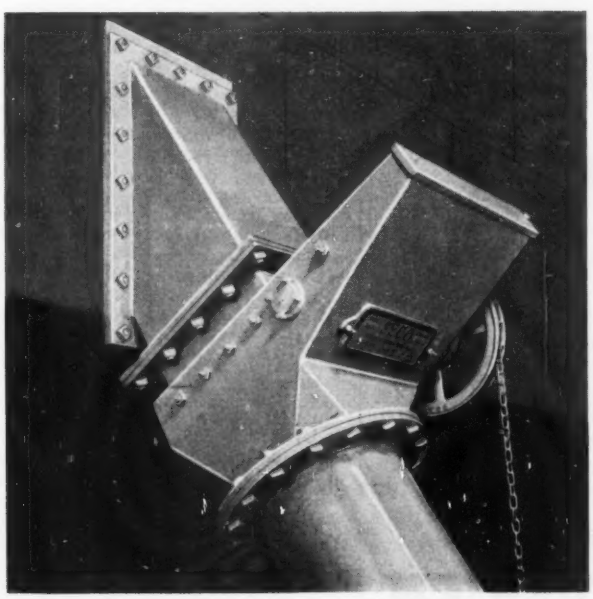
Name Here



The Operator With the S-E-Co. Coal Valve

S-E-Co. Coal Valve shown below is Style 2BS, designed for inclined installation. This style features 2" offset between inlet and outlet centerlines and a disc brake to prevent gate from self-closing.

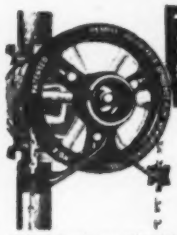


can rely on dependable, easy gate operation because the double racks and pinions prevent gate cocking and binding; the U-shaped gate keeps coal and moisture from operating parts and prevents sticking and wear; roller bearing equipped rollers with pressure greasing and dust-seals support the gate and insure free motion; and the operating shaft is mounted on anti-friction bearings.

Purchase your valve requirements from Stock Equipment Company, where valves are a specialty and receive the attention to design and construction they require. Stock Equipment Company has a full line of valves in sizes ranging from 6" to 42" designed to control coal, soot or siftings, or bulk materials. For bulletin or help on your valve problem, write to

STOCK EQUIPMENT COMPANY
745P HANNA BUILDING
CLEVELAND, OHIO

FOR SAFETY'S SAKE
Control Valves from the Floor



Babbitt
Adjustable
SPROCKET RIM
with Chain Guide

ELIMINATES
STEP-LADDER
CLIMBING
RISKS

• Range of 10 adjustable sizes take care of all valve makes and types; fits valve wheel diameters from 2 to 30 inches.

• Climbing on benches, machines, boilers or treacherous stepladders to control overhead valves is absolutely unnecessary, foolish risking of life and limb. Why permit such risks when the safe and sure BABBITT Adjustable Sprocket Rim with Chain Guide is available at such low cost? Overhead valves are conveniently and safely operated right from the floor!

• The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.

• *Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor*

BABBITT STEAM SPECIALTY CO.
1 Babbitt Square, New Bedford, Mass.

MARTINDALE
PROTECTIVE MASKS

PLACE HEAD BAND WELL UP AROUND HEAD TO KEEP FROM SLIPPING DOWN
PRESS NOSE BARS IN CLOSE AGAINST FACE TO HOLD PAD AGAINST THE NOSTRILS
PRESS EDGES OF FACE PLATE DOWN TO FIT FACE SNUGLY

Weigh Less than ½ ounce.

Clean, cool, comfortable. Excellent protection against non-toxic dusts except free silica. Replaceable cotton pads are inexpensive and sanitary.

Martindale Protective Masks	$.30 ea.
No. 1 Refills (Standard weight)	.02 ea.
No. 2 Refills (heavyweight)	.02½ ea.

Masks packed individually. Refills packed 25 to envelope. No. 2 (heavyweight) Refills contain twice as much filtering cotton as No. 1.

DISCOUNTS

Less than $10.00 list	Net
$10.00 to $24.99 list	10%
$25.00 to $99.99 list	15%
$100.00 and over	20%
Minimum, charge account or C.O.D.	$2.00
Minimum, cash with order	$1.00

If payment accompanies order we will pay parcel post or express charges.

MARTINDALE ELECTRIC CO.
1385 Hird Ave. Cleveland 7, Ohio

KECKLEY
FLOAT VALVES
for dependable, accurate liquid level control!

Controlling the liquid supply to open tanks is easier and more dependable when you do it with Keckley balanced float valves. They're engineered to give you long service with minimum maintenance — and protect you against costly failures that disrupt processing operations. The balanced feature insures constant even flow and positive closing action regardless of the incoming pressure. Keckley float valves are available in sizes from ½" to 12". Screwed, standard or extra heavy flanged connections.

- No. 15 Balanced inner valve double seat. Pressures to 125 lbs.
- Specify No. 14 single seat float valve where tight closing is required.
- Bronze bodies, integral seats ½" to 1½" inclusive. Semi-Steel bodies, bronze trim, renewable seats, 2" to 12" inclusive. Globe or angle patterns.
- Seamless copper floats standard. Stainless Steel floats available.
- Closed tank controls also available.

SEND FOR YOUR COPY OF NEW CATALOG 51-A

O. C. KECKLEY COMPANY
400 W. MADISON STREET CHICAGO 6, ILLINOIS

More APPOINTMENTS

Begins on page 226

ment Div in Kansas City. Kelly resigned to accept the position of executive manager of the **Cooling Tower Institute,** an association of major manufacturers of industrial water cooling equipment. Succeeding, Johnson in Chicago will be E Allen Bailey.

Owen L Taylor is named manager of engineering for the **Bryant Electric Co,** Bridgeport, Conn., wholly owned subsidiary of the **Westinghouse Electric Corp.** Taylor replaces E E Forstrom, who will retire next year. Also announced is the appointment of Ray H Timmons as manager of the corporation's Steam Div at South Philadelphia, Pa.

General Motors Corp appoints John W Brophy as works manager of the Cleveland Diesel Engine Div. P B Terhorst is named works manager of the Grantley plant of the **York Corp.**

Engineering Personnel

Allis-Chalmers Mfg Co names T G A Sillers as chief engineer of the switchgear section of the power dept. Other switchgear section appointments include J W Timmerman, assistant chief engineer; Albert Ewy, engineer-in-charge of switchgear design; and J H Michael, engineer-in-charge of switchgear development.

William L Ringland is named chief engineer of the motor generator section of Allis-Chalmers power dept. Additional section appointments include J F Sellers, assistant chief engineer; L T Rosenberg, engineer-in-charge of ac design; and Chester Weilbaecher, engineer-in-charge of dc design.

W C Sealey becomes chief engineer of the transformer section of Allis-Chalmers power dept; K P Wiederkehr is engineer-in-charge of transformer design; R P Marohn is engineer-in-charge of regulator design; D T Scag is engineer-in-charge of betatron design.

Rockwell Mfg Co announces the appointments of Howard J Evans as chief engineer and Robert J Sarraf as chief chemical engineer of the company's Meter and Valve Div.

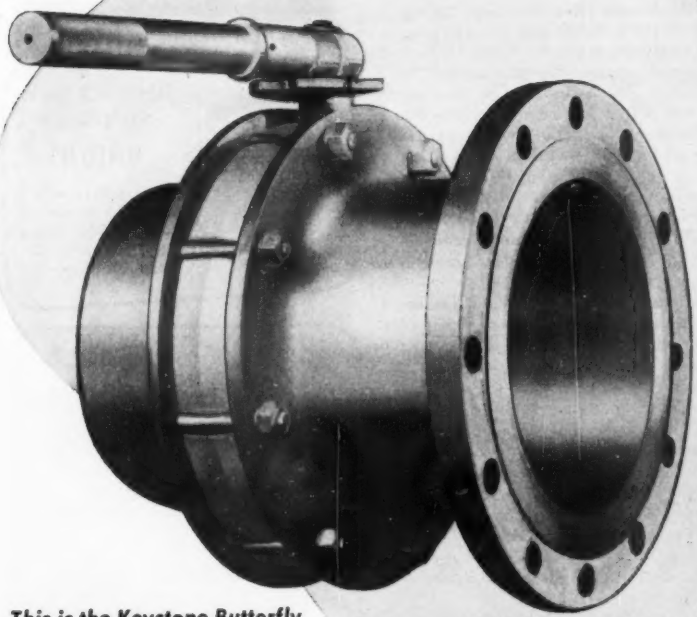
York Corp has created the position of engineering manager and appointed the following engineers to that post: S B Nissley, reciprocating compressors; R D Blum, central station air conditioning; R A Chadburn, heat exchange equipment; J H Anderson, turbo compressors; S P Soling, engineered applications; P B Moore, single-room air conditioners; A E Diehl, self-contained air conditioners; H A Brysselbout, ice makers; P G Thayer, hermetic compressors.

Sales Personnel

Honan-Crane announces the appointment of D J Jones as general sales manager. **Johns-Manville** names William J Buckle general sales manager of the Celite Div. to succeed William D Van Arnam who has retired.

George D Thomas joins the application engineering and field service staff of the **Sterling Engine Co.** Thomas is internationally known in the field of electric

How many times have you wished for a valve just like this?



This is the Keystone Butterfly Valve that was displayed at the New York Power Show.

The Butterfly or disc, when closed, comes in contact with this special oil-resistant rubber seat for a quick and complete shut-off or vacuum seal.

THERE'S A MORAL* FOR YOU IN THE STORY OF HOW MURRAY RUBBER HELPED KEYSTONE TOOL SOLVE A TOUGH PROBLEM

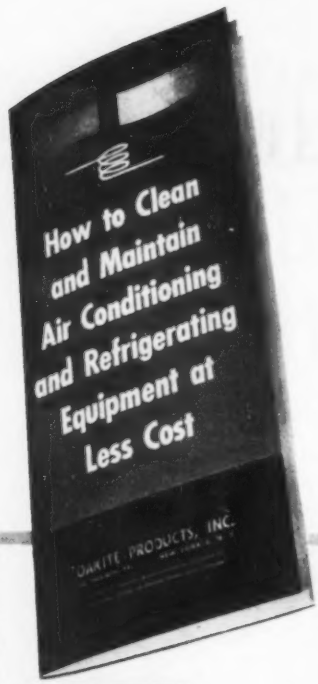
There are hundreds of applications in the oil, chemical, cement, rubber, agricultural and various other industries where this new Keystone Butterfly Valve has proved to be "just what the doctor ordered." Manufactured by Keystone Tool Corp., Houston, this valve is constructed to give a unique control of flow with no resistance or turbulence. It is full-opening, self-cleaning and is designed to effect a seal for pressure or vacuum.

The heart of the Keystone Butterfly Valve is the special oil-resistant rubber seat, compounded and molded by Murray Rubber Company.

*Murray . . . one of the nation's largest producers of mechanical rubber goods . . . provides complete engineering and machine shop facilities to help you find the solutions to your rubber problems, both natural and synthetic. Write or call us.

Murray Rubber

MURRAY RUBBER CO.
HOUSTON TEXAS



FREE...

for the asking

GET IT!!

IF you are responsible for the efficient operation of air conditioning equipment, send for a FREE copy of this handy little booklet.

It tells you what to do about lime scale. How to get rid of it. How to prevent it from forming. And the booklet discusses that other enemy of efficiency . . . slime. Describes simple, low-cost ways to prevent it from fouling up lines, tanks and spray jets.

Other items of interest: Cleaning finned coils of air washers, cleaning aluminum plates and screens, descaling cold diffusers, cleaning filter screens.

For your free copy, simply drop us a line TODAY. Oakite Products, Inc., 18A Rector St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING

OAKITE

MATERIALS • METHODS • SERVICE

Technical Service Representatives Located in Principal Cities of United States and Canada

More APPOINTMENTS

Begins on page 226

power generation, having designed and supervised power installations in many parts of the world. Among them is the Voice of America Tangiers Station.

George B Bond is appointed to the newly created post of sales promotion manager of the Alemite lubrication equipment and Stewart-Warner Instrument Div of **Stewart-Warner Corp.** J F Dawson has been named engineer-in-charge of induction heating sales in addition to his former capacity as engineer-in-charge of induction heating design of **Allis-Chalmers** electronics section. Dawson succeeds J R Roe who resigned.

Cutler-Hammer, Inc assigns M R Brice as division manager, industrial control sales. E W Peterson was appointed general sales manager of **American Blower Corp,** covering all divisions of the company.

Westinghouse Electric Corp has appointed Victor D Kniss general sales manager of consumer products. Kniss formerly was general merchandising manager for the Firestone Tire & Rubber Co. Also promoted was Alfred E Lambert Jr, who has taken the post of New England manager of distribution apparatus sales for Westinghouse.

Harry L Smith Jr is made staff manager product sales, for **Aluminum Co of America;** W T Mitman succeeds him as manager of sheet and plate sales. W S McChesney is new manager of foil sales.

At **Kaiser Aluminum & Chemical Sales, Inc,** Richard E Hanson is named assistant to the general sales manager. Wallace A Davidson becomes manager of the Kansas City office, and Donald F Sheridan is new branch representative of the Wichita, Kansas, sales outlet. W Lyle Sturtevant is appointed to the electrical conductor staff in the Chicago office.

Pete E Walker is appointed industrial sales engineer for the **Parker Appliance Co,** Cleveland, with headquarters in St. Louis, and William O Murray is named industrial sales engineer with headquarters in Pittsburgh.

Earle H Schlitt, formerly a project engineer for Wolff & Munier, contractors, New York City, has joined the air conditioning sales department of **The Trane Co.**

New Distributors

Builders-Providence, Inc has established a service center in Seattle, Wash., headed by L W Armstrong. The territory covered includes Oregon, Washington and Western Idaho, Provinces of British Columbia and Alberta. The Seattle sales office and service center is located at 913 Arctic Bldg, Seattle 4, Wash.

The Parker Appliance Co names the Ardun Supply Co, Tulsa, Okla., as a distributor of industrial tube fittings and tube fabricating tools. Headquarters are at 317 S Detroit, Tulsa, Okla.

An exclusive franchise for the sale of direct-fired heaters in Michigan, northern Illinois and northern Ohio has been given to Arnold A Kosarin & Associates, Detroit, by the **National Heater Co.** Location is at 604 Boulevard Bldg, Detroit 2, Mich.

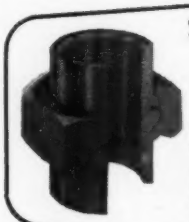
Catawissa

PERFECT SEAL

Unions

HOT FORGED from solid, rectangular steel bars, designed and produced for dependable, long-life service under the severest piping conditions!

A TYPE FOR EVERY USE!
FOR ALL PRESSURES!
FOR ALL TEMPERATURES!



Standard & Double Extra Heavy UNIONS

Available with screwed or socket weld ends. 3000-lb. sizes ⅛" to 3"; 6000-lb. sizes ⅛" to 2".

ORIFICE UNIONS

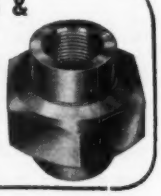
With screwed or socket weld ends. 3000-lb. and 6000-lb. service.

MALE & FEMALE UNIONS

With steel-to-steel, bronze-to-steel, stainless steel-to-steel or orifice seats. 3000-lb. service only.

FULL STAINLESS & FULL ALLOY STEEL UNIONS

With screwed or socket weld ends. 3000-lb. and 8000-lb. service.



WRITE FOR CATALOG 11

showing the complete Catawissa line of Perfect Seal products

CATAWISSA VALVE & FITTINGS COMPANY

206 MILL ST. • CATAWISSA, PA.

Automatic Voting Machine Corporation casts its vote for **ES COMPRESSORS**

Voters in 29 different states and the Territory of Hawaii indicated their choice in the November elections by turning levers on machines made by the Automatic Voting Machine Corp. of Jamestown, N. Y. This company and its predecessors have been engaged in the development and production of automatic voting equipment since 1898.

When it came to choosing a compressor to aid in its manufacturing processes back in 1934, this leader in its field chose the leader in the compressor field . . . Ingersoll-Rand's ES compressor. Satisfaction was proven when the company chose a duplicate ES compressor in 1947 to take care of its increasing air power needs. Both machines have been operating since that time, supplying compressed air to punch and drill presses and a variety of I-R air tools.

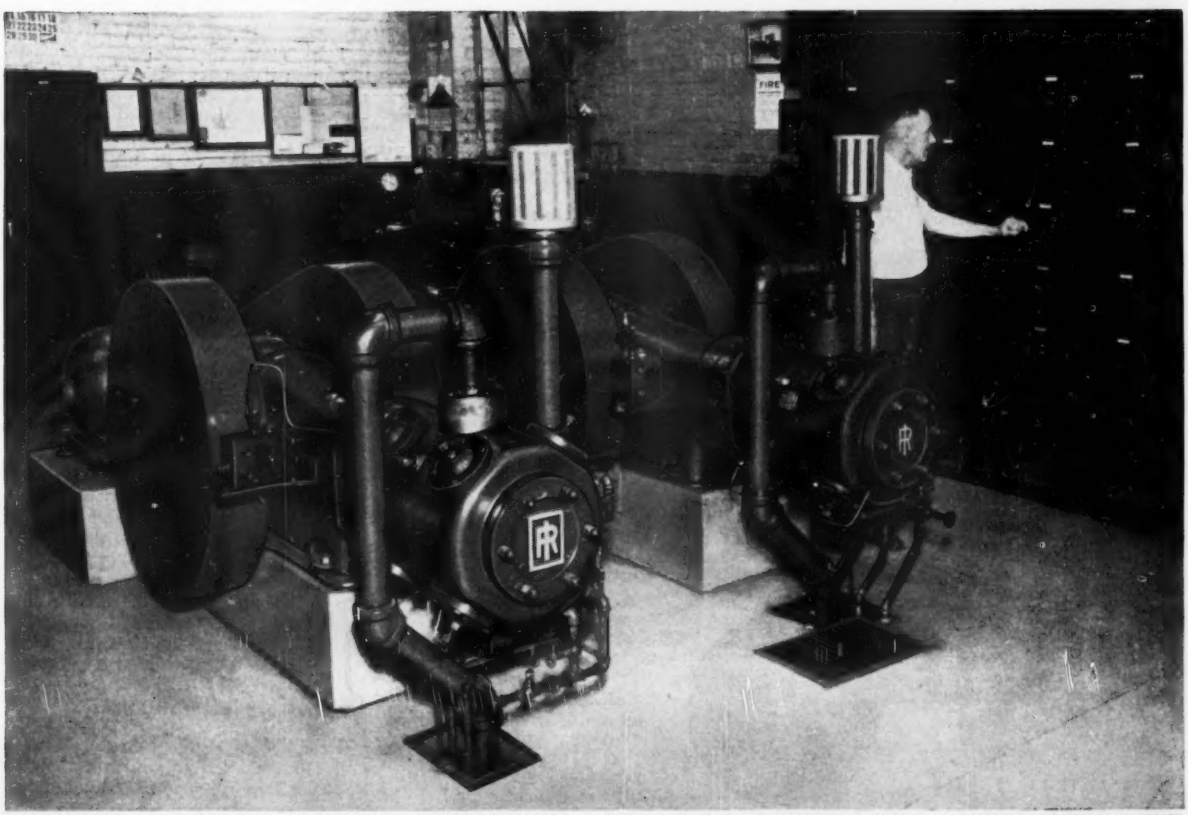
The ES compressor is designed to stand up under heavy-duty, 24 hour continuous full-load service over many years. Efficiency stays high; maintenance stays low. Sizes 5 to 125 hp with pressures from 5 to 150 psi.

The ES is of the double-acting crosshead type and is equipped with highly efficient, durable and quiet-operating Ingersoll-Rand Channel Valves.

Whatever your compressed air requirements, Ingersoll-Rand has a size and type compressor that will best serve your needs. A call to your nearest I-R branch will bring complete details.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 845-1

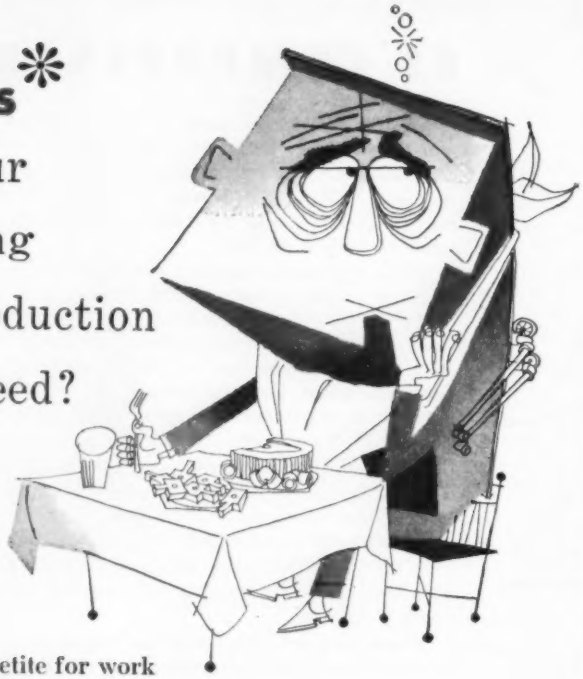


COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO-BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

does

coil-itis *

have your processing tank production off its feed?



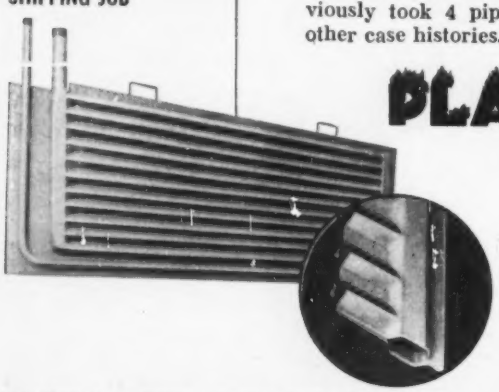
When the appetite for work of your heating and cooling processes diminishes, the trouble may well be coil-itis. For, downtime due to pipe failures and limitations can seriously delay your production flow. Switch to Platecoils, the new tonic for production, as revolutionary as the new wonder drugs. Platecoils take 50% less tank space leaving more room for greater payload. They heat or cool 50% faster. They simplify maintenance and save hours of downtime. Equally important, Platecoils cost as much as 50% less in the first place. Platecoils cure production troubles involving heat transfer and give production a shot in the arm.

Write for Bulletin P79 today!

PLATECOILS SAVE 50% IN HEAT TRANSFER COSTS

PLATECOILS ELIMINATE A 6-TO-8 HOUR-A-DAY CHIPPING JOB

At Sealed Power Corp., installation of Platecoils has completely eliminated a 6-to-8 hour-a-day chipping job. Three Platecoils now heat a tank that previously took 4 pipe coils. Ask about other case histories.



PLATECOIL

REPLACES PIPE COILS

* Coil-itis — Diagnosed as tank heating and cooling problems. Platecoils — the prescription for solving pipe coil problems.

PLATECOIL DIVISION, KOLD-HOLD MANUFACTURING CO., LANSING 4, MICHIGAN

More APPOINTMENTS

Begins on page 226

R A Lister & Co, Dursley, England, gives sole distribution of their diesel engine line to the National Supply Co, Springfield, Ohio. **Reliance Electric & Engineering Co** appoint Smithco Engrg as sales representatives in Oklahoma with offices at 3348 S Erie St, Tulsa, Okla. DeBothezat Fans Div of **American Machine & Metals, Inc** assigns the Air, Dust and Fume Control Co, 50 Church St, New York, N. Y., new representatives for the greater New York area and northern New Jersey.

Consolidations, Purchases, etc

Headquarters for the sales, engineering and production of Multi-V-Drives and Allspeed Drives have been consolidated at the Oil City, Pa., plant of **Worthington Corp.** A new Mechanical Power Transmission Div will handle Multi-V-Drives, formerly manufactured at Buffalo and Wellsville, N. Y., and Allspeed Drives formerly made at Holyoke, Mass. Sales for the division will be under D E Tessendorf, manager, and H W Kurmo, assistant manager. Fred G Moore is named chief engineer of the division, and manufacture will be under W F Weinreich, works manager of the Oil City plant.

Equipment & Controls Engineers, Inc is the name of a new engineering organization specializing in the design and construction of complete coordinated process controls. Walter F Gieryk has been named president and Mifflin S Jacobs vice-president.

Tube Turns, Inc, Louisville, Ky, manufacturers of welding fittings and flanges acquired the Kerotest Mfg Co, Pittsburgh, Pa, makers of steel and brass valves.

Charles A Gerber and Arnold A Tannenbaum have formed **Rutley Industries, Inc,** 415 Greenwich St, New York, N. Y. to produce special cleaning compounds and a standard line of welding and brazing compounds in addition to a consulting service.

Walter Kidde Nuclear Laboratories is establishing new laboratory facilities at 975 Steward Ave, Garden City, Long Island, N. Y. The **D J Murray Mfg Co,** Wausau, Wis., has completed a new addition to their plant. **Marlow Pumps,** Ridgewood, N. J. has put into operation a complete branch factory in De Queens, Arkansas.

Anaconda Copper Mining Co has announced completion of organization of its subsidiary, Anaconda Aluminum Co, formerly Harvey Machine Co, Inc, of Montana. Francis O Case has been elected president. The 50,000 ton-per-year aluminum reduction plant will be built near Columbia Falls in Flathead County, Montana, and will draw power from nearby Hungry Horse Dam.

Societies, Schools, Institutions

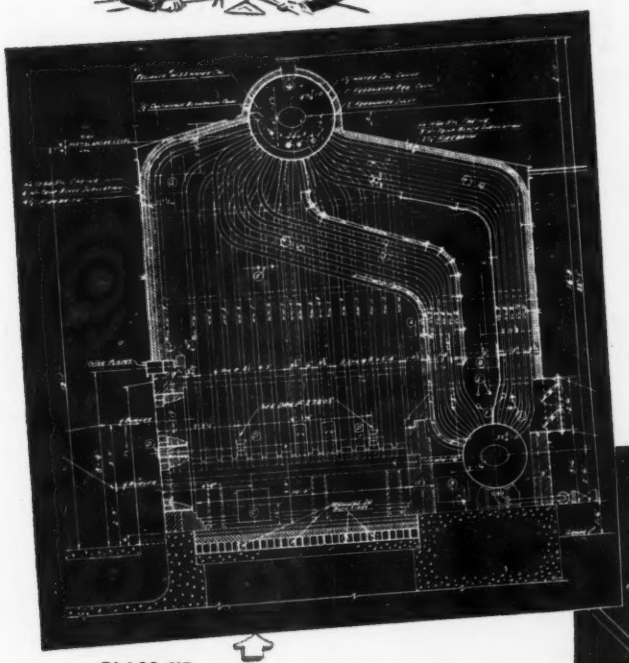
Dr Miklos Hetenyi, Walter P Murphy professor at the Northwestern University Technological Institute, has been appointed to a five-year term on the executive committee of the Applied Mechanics div of

Industry Approved

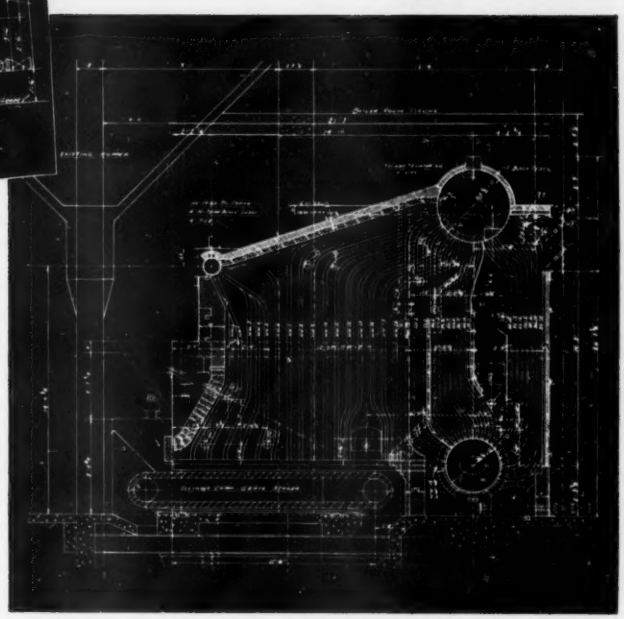
Two-Drum

STEAM GENERATORS

by Vogt



CLASS VF
A 22,000 pounds steam per hour unit installed at Indiana Farm Bureau Refinery, Mt. Vernon, Ind.



CLASS VS
The Seelbach Hotel, Louisville, Ky. is served by this 30,000 pounds steam per hour boiler.

A wide variety of industrial plants and other users of steam for power, processing, or heating have found these efficient Vogt Two-Drum Type Boilers to be the answer to their diverse steam generating requirements.

Class VF units provide maximum capacity in limited floor space and head room, while Class VS is best adapted to installations not having such restrictions. Each has a large furnace volume and a high ratio of radiant heating surface. The furnace design assures proper combustion of fuels fired in suspension or with various type of stokers.

A bulletin with general information and showing typical installations is available on request.

Typical Users...

FOOD PROCESSING PLANTS

DISTILLERIES • HOTELS

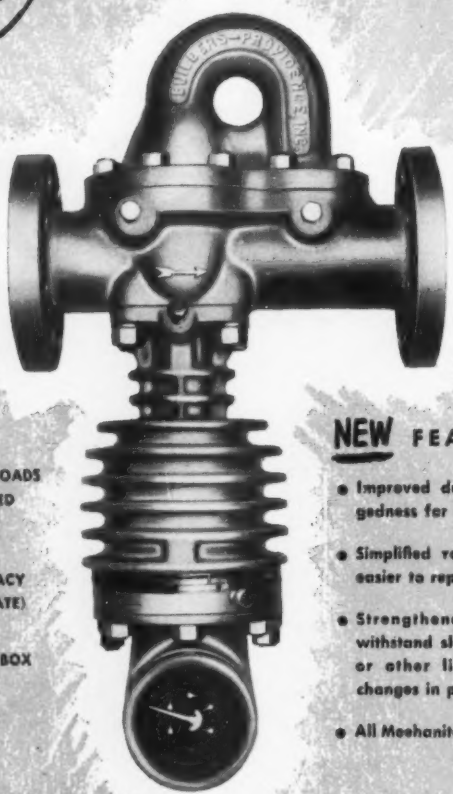
HOSPITALS • CHEMICAL PLANTS

PETROLEUM REFINERIES

HENRY VOGT MACHINE CO., Louisville 10, Kentucky

BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS, CHARLESTON, W. VA.

NEW MODEL Shuntflo Meter for STEAM, AIR or GAS



METERS PEAK LOADS ABOVE RATED CAPACITY

•

HIGH ACCURACY (± 2% OF RATE)

•

NO STUFFING BOX TO LEAK

NEW FEATURES

- Improved durability and ruggedness for longer service
- Simplified rotor mechanism — easier to repair or replace
- Strengthened rotor shaft to withstand slugs of condensate or other liquid, or sudden changes in pressure
- All Meehanite iron body casting

BUILDERS NEW MODEL SHUNTFLO METER — for steam, air, or gas — gives you answers to steam consumption in POUNDS, not GUESSES. Meters are available in two styles: Model SMKS for 2" to 14" lines — Model SMDH for 1" and 1½" lines. Send for descriptive Bulletins 400-F1 and 400-F2. Builders-Providence, Inc. (Division of Builders Iron Foundry), 354 Harris Avenue, Providence 1, Rhode Island.

See the NEW Model Shuntflo Meter at Booth 1344 International Heating & Ventilating Exposition

BIF INDUSTRIES BUILDERS PROVIDENCE Instruments BUILDERS

More APPOINTMENTS

Begins on page 226

the **American Society of Mechanical Engineers.**

Charles H Marks was chosen to the engineering staff of **Bituminous Coal Research, Inc. Mellon Institute** announced the appointment of Dr Raymond H Hartigan as assistant director of research on the Institute's executive staff. Prof S M Marco was named chairman of the department of mechanical engineering at **Ohio State University. The University of Buffalo** appointed Roger K Smith, associate professor in engineering as assistant dean of the school of engineering.

Obituaries

Robert E Dillon, 68, vice-president and assistant to the president of the Boston Edison Co, died on October 17 at his home in Cambridge, Mass.

William Olanda Skinner, 68, who had been associated with the Virginia Electric and Power Co for many years, died in Petersburg, Va., on October 23.

William Ray Culbertson, 62, vice-president of Rust Furnace Co, died October 29 in Mt. Lebanon, Pa., after a long illness.

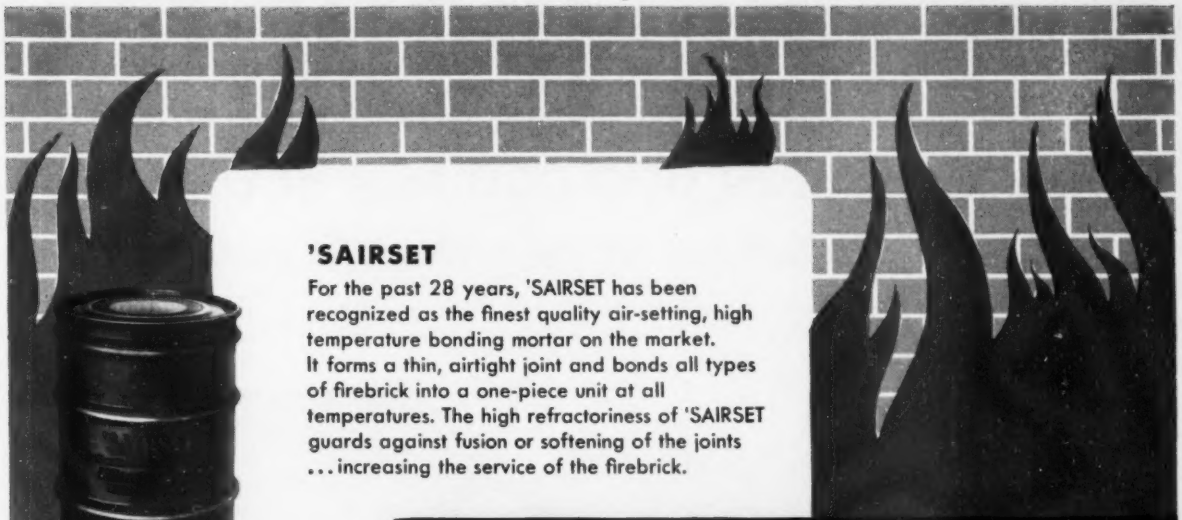
Franklin T Griffith, 82, former president and chairman of the board of the Portland General Electric Co and at his death chairman of the board of the Portland Traction Co, November 7 in Portland, Oregon.

Scholarships for study in the fields of science, engineering, or business administration at Cornell University will be established this year by the **Rome Cable Foundation, Inc,** according to A D Ross Fraser, president of the Foundation.

Reservoir gates have been closed at **Albeni Falls Dam,** under construction on the Pend Oreille River near Newport, Wash. This will impound 1,400,000 acre-ft of water that can be released this winter. It will add 100,000 kw to power production at downstream dams on the Columbia River.

New hydro-electric development of **British Columbia Power Commission** at Clowhom Falls has initial capacity of 4000 hp. There are two 2000-hp turbines and two horizontal shaft generators rated at 1875 kva. Second stage will ultimately have two 4000-hp vertical-type turbines and generators, increasing plant capacity to 12,000 hp. This is the Commission's third hydro development.

California Oregon Power Co has completed the third of eight projected power plants on the North Umqua River in southwestern Oregon. This is the Soda Springs plant, completed at a cost of $3.5 million; aggregate cost of the eight plants will be about $23.3 million. They will supply a total increase of 145,000 kw to the Copco system, with the three plants now in service supplying about 71,750 kw of the total.



'SAIRSET

For the past 28 years, 'SAIRSET has been recognized as the finest quality air-setting, high temperature bonding mortar on the market. It forms a thin, airtight joint and bonds all types of firebrick into a one-piece unit at all temperatures. The high refractoriness of 'SAIRSET guards against fusion or softening of the joints ... increasing the service of the firebrick.

A. P. GREEN BONDING MORTARS

ADD EXTRA LIFE AND PROTECTION TO FIREBRICK LININGS . . . REDUCE DOWN-TIME

KD-2

An air-setting, high temperature bonding mortar that will not fuse or soften in the joints. KD-2 develops excellent plasticity and workability immediately on mixing — no long soaking period required. Gives maximum protection because it does not shrink ... there are no cracks for flame and slag to attack. KD-2 is shipped dry and will not freeze, deteriorate or lose its working and bonding characteristics in storage.

DIAMOND-JO

A dry, heat-setting high temperature mortar for laying firebrick. DIAMOND-JO is free from joint shrinkage or expansion ... provides strong airtight joints at high temperatures ... recommended for temperatures above 2000° F. It is ground extrememely fine ... makes thin brick-to-brick joints.

FOR SPECIFIC RECOMMENDATIONS, without obligation, on your refractory problems or requirements, call your local A. P. Green distributor ... he is listed in the yellow pages of your telephone directory ... or write direct.

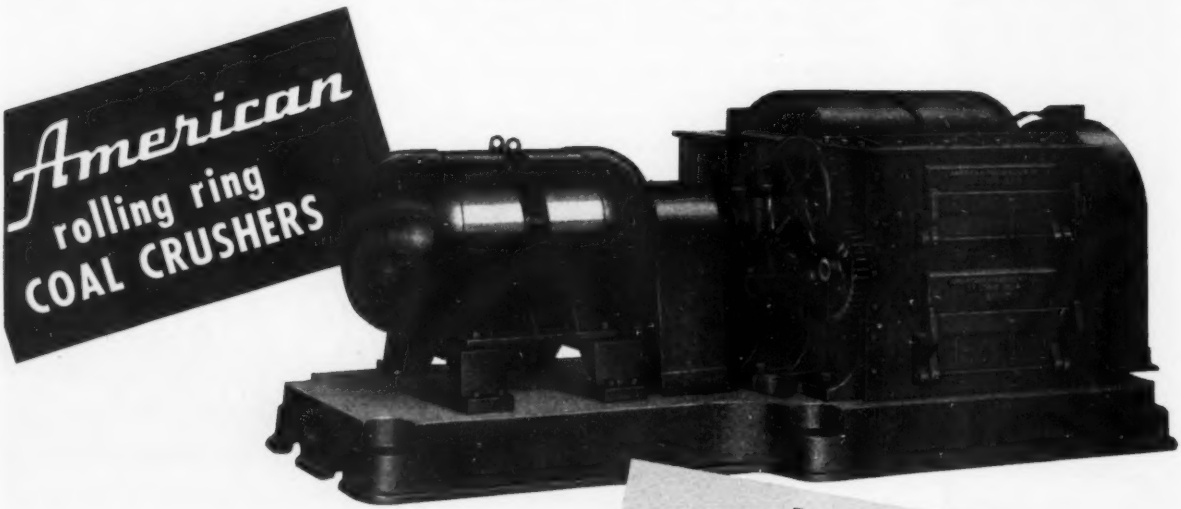
A. P. Green REFRACTORY PRODUCTS

A. P. GREEN FIRE BRICK COMPANY
Mexico, Missouri, U. S. A.
In Canada
A. P. GREEN FIRE BRICK CO., LTD.
Toronto 15, Ontario

DISTRIBUTORS IN THE PRINCIPAL CITIES OF THE WORLD

CRUSHING UNLIMITED!

the story of 61,000,000 tons of coal crushed at less than 1¢ per ton!



The facts are in! The story of American Crusher performance—rugged, long-life-low-cost performance—is now available for your careful study. Not just one case history, or scattered reports—but a thorough survey of American installations (power plants, central stations, and mines) across the nation. Here are the "crushing" facts:

Total Tonnage Handled .....61,000,000 Tons
Average Age of Crushers .....9.5 Years
Replacement Parts (Including Standby Parts)
1/10 of 1¢ per Ton

There can be no better proof of American's superlative endurance and economy of operation!

Typical Survey Results

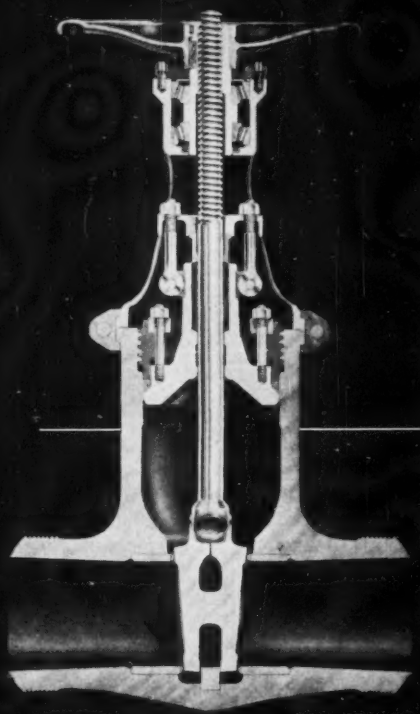
LOCATION	CRUSHER	TONNAGE	PARTS REPLACEMENT COST
N. J. Central Station	42-S	6,000,000 Tons	$.00025 per ton. 20-year-old installation!
W. Va. Industral Power Plant	38-S	10,008,000 Tons	$.0008 per ton. 10 years in service!
Illinois Coal Mine	AC3-E	4,000,000 Tons	$.0005 per ton for 10 years service!
W. Va Coal Mine	38-S	2,514,000 Tons	$.0007 per ton. 23 years old!
Ill. Power Plant	42-S	2,950,000 Tons	$.0004 per ton. 6 years in service.
	AC3-E	4,000,000	$.0005 per ton for 10

WRITE today for your copy of "Crushing Coal at Less Than 1¢ Per Ton"

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 Macklind Ave.
St. Louis 10, Mo.



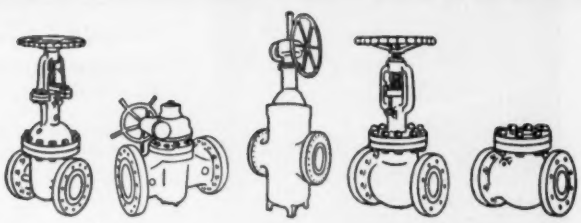
STEEL

COMPLETE LINES OF CAST STEEL VALVES AND PIPE FITTINGS are manufactured by Walworth in a variety of pressure classes, types, sizes, and patterns for general industrial use. Walworth also manufactures cast steel valves for specific service applications.

Walworth produces steel bar stock valves, and cast steel valves made of carbon steel, carbon molybdenum steel, corrosion-resistant, and heat-resistant alloy steels. Included are gate, globe, angle, check, and lubricated plug types. Sizes range from ⅛ to 30 inches; pressures range up to 5,000 psi. Full information is contained in Walworth General Catalog 52, a copy of which will be forwarded if requested on business letterhead.

Walworth also manufactures complete lines of valves and fittings made of bronze, iron, and special alloys as well as steel. Walworth-made valves, fittings, and pipe wrenches total approximately 50,000 items.

Walworth engineers will be glad to help you with your problems. For full information, call your local Walworth distributor, nearest Walworth sales office, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, New York.



Illustrated in section is an 8-inch Series 900, Walworth Pressure-Seal Cast Steel Gate Valve designed for high-pressure, high-temperature service. Pressure-Seal Valves are available in Series 600, 900, 1500 and 2500; sizes 1 to 16 inches. Small Cast Steel Valves, Series 1500, in angle and Y-globe types, are also available in sizes ranging from ¼ to 2 inches.

WALWORTH

Manufacturers since 1842

valves . . . pipe fittings . . . pipe wrenches

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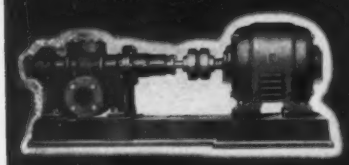
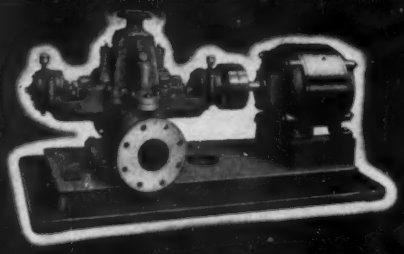
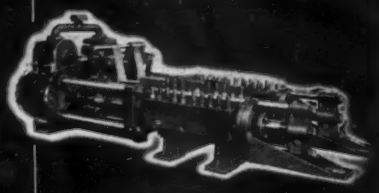
Gear-in head Screw Pump





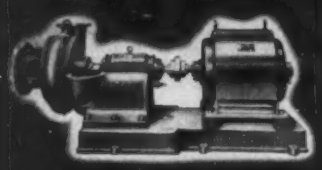
Warren Condensate Pump

Warren Horizontal Duplex
Hydraulic Pump



WARREN PUMPS

Maintain efficiency • Operate at low cost • Are long-lived



Warren Type "L" Single-Stage
Single-Suction Liquor Pump

CENTRIFUGAL

Single and Multi-stage
Pressure range: Up to 1200 P. S. I.
Capacities: Up to 50,000 G. P. M.
Types: Horizontal and Vertical
Impellers: Open or Enclosed

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Horizontal and Vertical Single Piston
Horizontal and Vertical Duplex Piston
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Steam Heat Vacuum
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WARREN-QUIMBY SCREW PUMPS

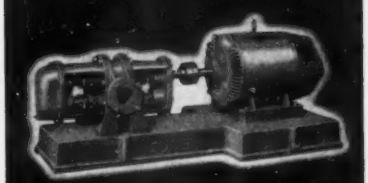
Gear-in-head and External Gear and Bearing
Capacities: Up to 3000 G. P. M.
Pressures: Up to 200 P. S. I. on low viscosity liquids; practically unlimited on high viscosity liquids
Horizontal or Vertical Mounting

WARREN-QUIMBY ROTARY PUMPS

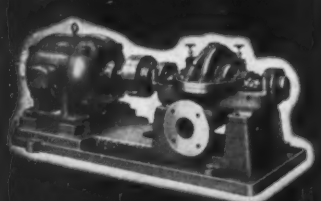
Gear-in-head and External Gear and Bearing
Capacities: Up to 1000 G. P. M.
Pressures: Up to 250 P. S. I.
Horizontal or Vertical Mounted

Send your pumping problem to us, Warren Engineers will recommend the right pump for the job.

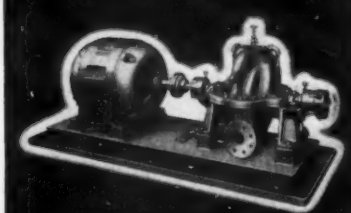
P-28



Warren-Quimby External Gear
and Bearing Rotex Pump



Warren Type DBL, Single-Stage
Double Suction, Centrifugal Pump



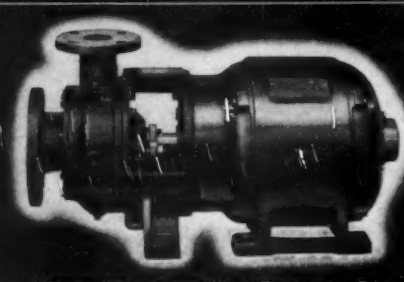
Warren Two-Stage Volute
Centrifugal Pump

WARREN QUIMBY PUMPS

WARREN STEAM PUMP COMPANY, INC.

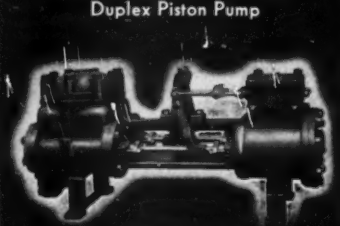
WARREN, MASSACHUSETTS

Warren 4- and 6-Stage
Centrifugal Pumps



Warren "Compacunit"—4 Types—42 Sizes

Warren Horizontal "Realwear"
Duplex Piston Pump



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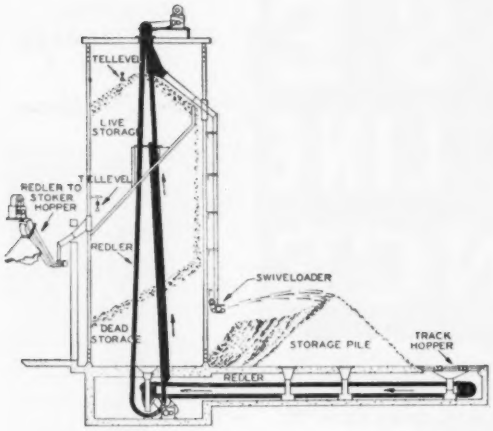
Contribute to $90,000 Annual SAVINGS in ONE PLANT



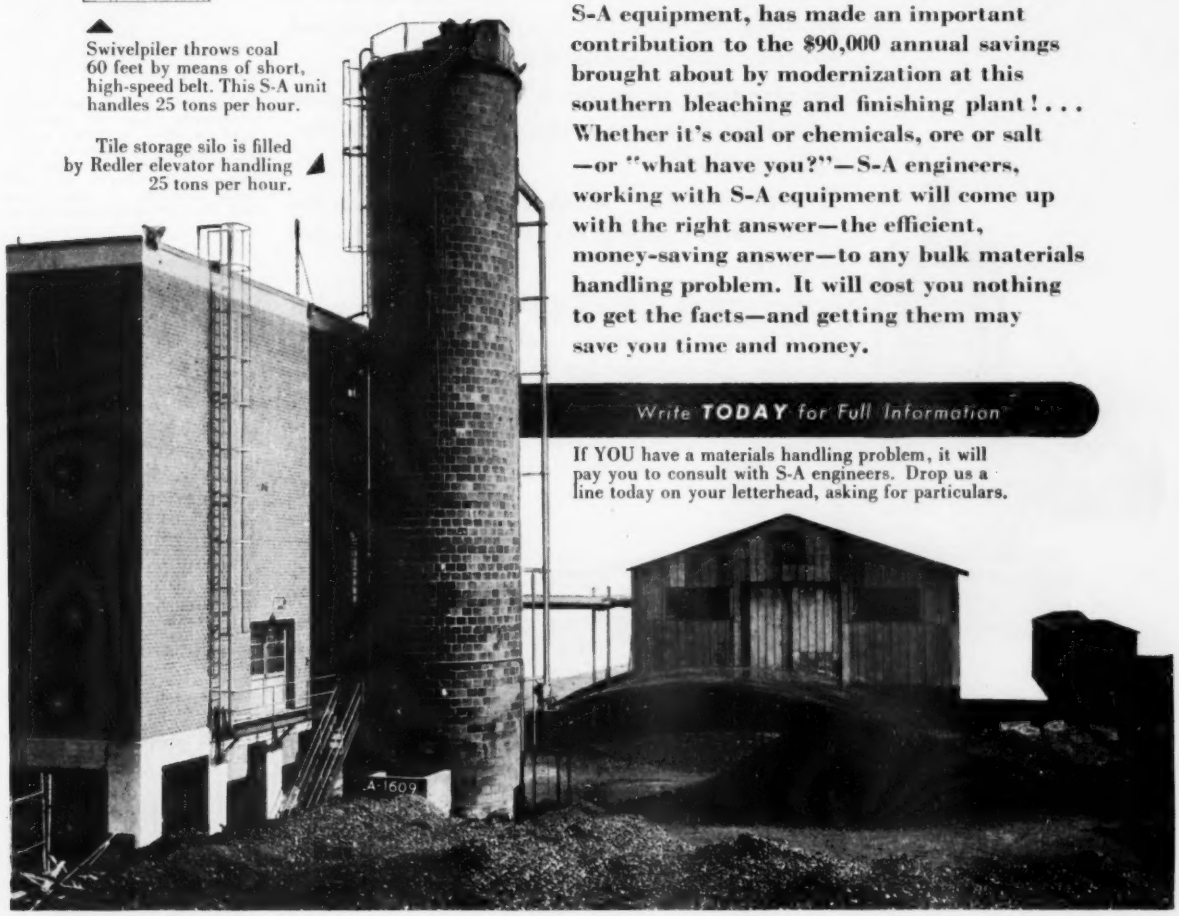
Swivelpiler throws coal 60 feet by means of short, high-speed belt. This S-A unit handles 25 tons per hour.

Tile storage silo is filled by Redler elevator handling 25 tons per hour.

Lower coal handling costs, with the aid of S-A equipment, has made an important contribution to the $90,000 annual savings brought about by modernization at this southern bleaching and finishing plant! . . . Whether it's coal or chemicals, ore or salt —or "what have you?"—S-A engineers, working with S-A equipment will come up with the right answer—the efficient, money-saving answer—to any bulk materials handling problem. It will cost you nothing to get the facts—and getting them may save you time and money.

Write **TODAY** *for Full Information*

If YOU have a materials handling problem, it will pay you to consult with S-A engineers. Drop us a line today on your letterhead, asking for particulars.



Belt Conveyors
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ZIPPER Conveyor-Elevators
Weigh Larries
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DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

For an Important INCREASE IN PROCESSING LINE PERFORMANCE

The "1000" Valve, upon installation, goes to work smoothly and effectively without that frequent attention ordinarily experienced.

You don't get those valve "kick-ups" that cause production delays and figure mighty costly over a given period.

"Straight line flow" which is incorporated in the "1000" valve design is the reason you avoid valve troubles.

To find out how this "STREAMLINED" design works to your advantage in elimination of failures, speedier production, no spoilage, and in lower costs, send for Bulletin 962.

There are no complicated inside works in the "1000" valve. As a matter of fact, there is only the one vital moving part — the seat piston. There are no restricted passages—no small ports — no aggregation of close fits.

CASH STANDARD Streamlined PRESSURE REDUCING VALVE TYPE 1000

Maximum Capacity When Needed Most • Accurate Pressure Control Under Toughest Working Conditions Trouble-Free Service • Smooth Operation • Tight Closure • Accurate Regulation • Speedier Production Results • Elimination of Failures • Constant Delivery Pressure • Cost Saving Operation • No Spoilage • Practically Zero in Maintenance Costs

CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
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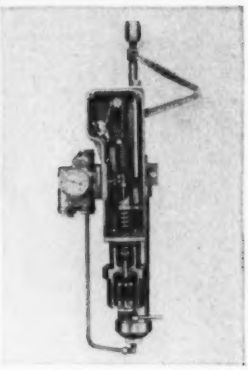
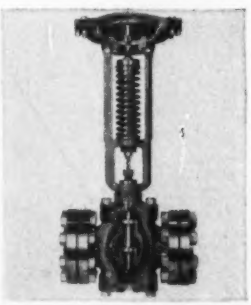
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

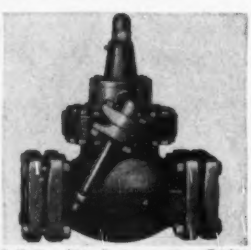
Send for them



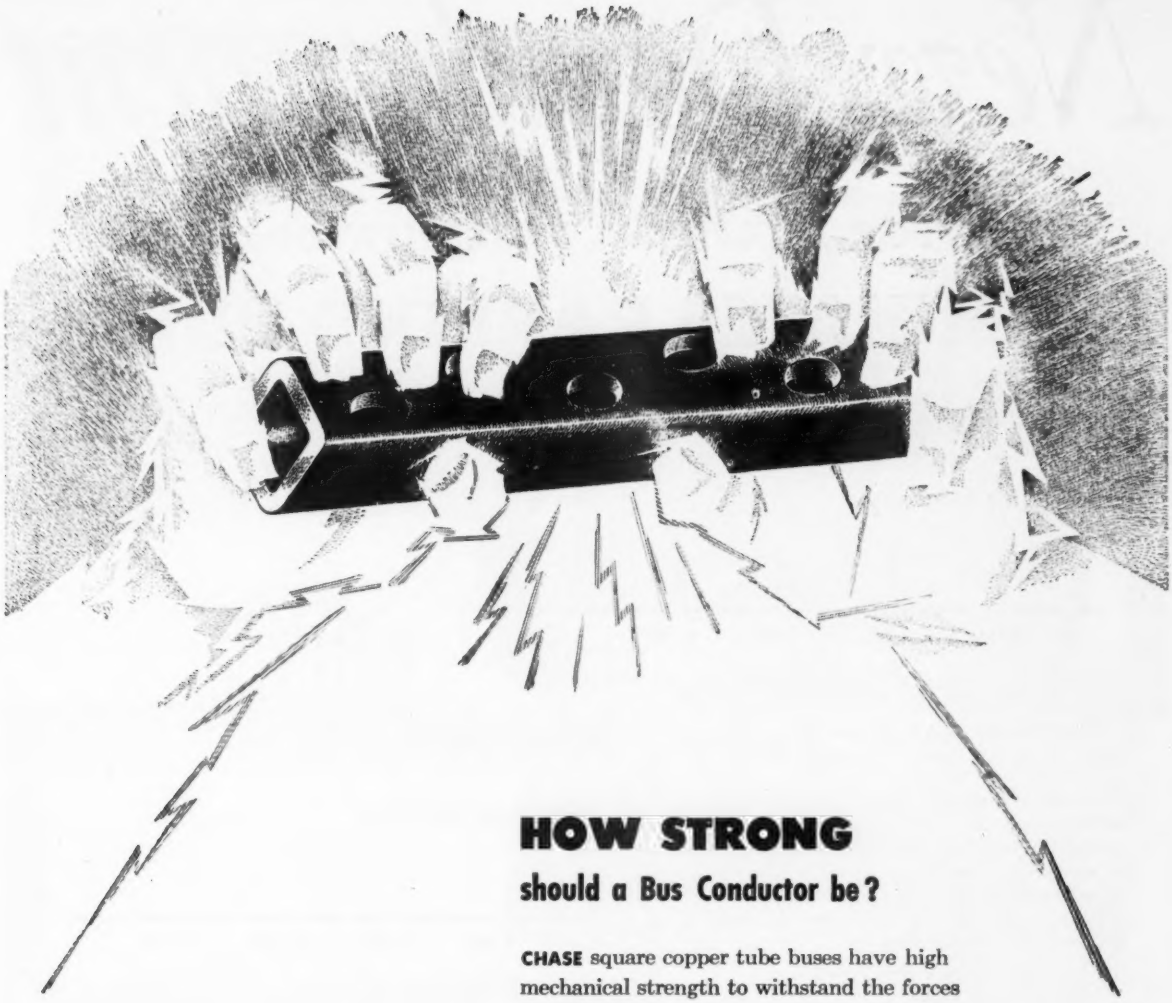
Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.



Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.



Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



HOW STRONG
should a Bus Conductor be?

CHASE square copper tube buses have high mechanical strength to withstand the forces caused by heavy short circuit currents. They have relatively large cross-sectional areas to give maximum structural strength. This permits longer spans between supports without unduly large sags.

Easily assembled and erected . . . with high thermal conductivity and low resistance voltage drop and power loss per pound of metal . . . these bus conductors are well worth your consideration. Write Dept. PO 153 for the Chase Bus Conductor Brochure.

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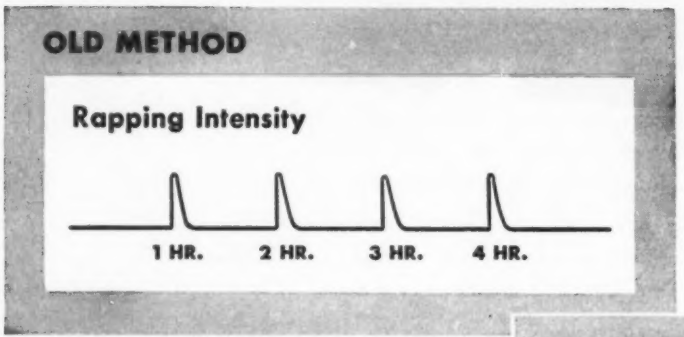
New Development

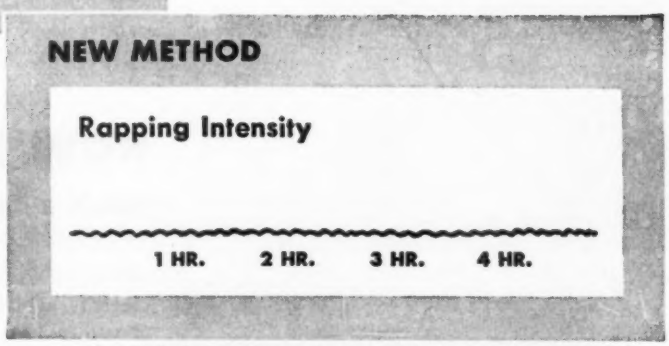
FOR ELECTRICAL PRECIPITATORS

ELIMINATES RAPPING PUFFS



Old Method of Rapping Resulting in Rapping Puff

Here are two simple diagrams that clearly demonstrate the importance of the new method of rapping developed by Research Corporation. The first shows the old way in which dust is shaken loose from electrodes at *periodic* intervals, causing intermittent puffs or clouding.



New Method of Continuous Rapping Eliminating Rapping Puffs
Rapping Intensity

This second diagram illustrates the new scientific method of cleaning electrodes. It involves continuous or sequential rapping, every minute or less, at a controlled vibrational intensity. This converts precipitation from a batch operation to a *continuous and uniform process.*

This is another major contribution by Research Corporation to the field of electrical precipitation. Constant research and development work for the past 39 years has resulted in many other improvements over the first Cottrell Precipitator. These advances plus the unequaled experience gained through over 1000 installations, listed at right, assure you of a profitable solution to your specific problem.

RESEARCH CORPORATION INSTALLATIONS

55 Carbon Black Plants
208 Metallurgical Installations
215 Acid Plants • 34 Paper Mills
293 Detarring Installations
251 Power Stations
86 Steel Plants • 114 Oil Refineries
and Miscellaneous Installations

Want to know more about the new Rapping System? Bulletin FA contains additional data. Send for your copy.

RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
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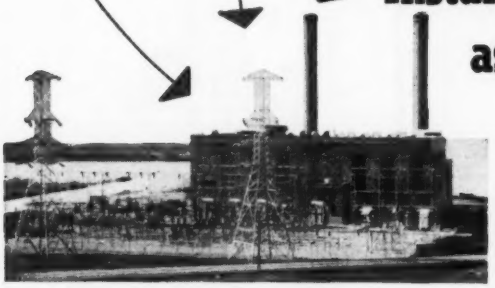
RC-15

NAVCO

Installations in Central Power Stations assure Absolute Dependability



FOR almost half a century Navco has specialized in the fabrication and erection of Piping Systems for the highest operating conditions.

The "first" base load Central Station Piping System operating at 1350 lbs. and 900° (back in '30)—the "first" carbon moly to be used in a complete Steam System of Central Station Piping—one of the "first" field x-rayed systems of Steam Piping and one of the "first" Piping jobs to serve a 1,000,000 lb. per hour boiler are among some of the many Navco installations.

Consult Navco for your next Piping job.

NAVCO PIPING

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • BUFFALO • CINCINNATI

FOR LOW-COST MAINTENANCE with the greatest of ease!

See how Darling cast steel gate valves save you time and money!

YOU know how important low-cost, *easy* maintenance can be. It's one of many Darling Valve features worth shouting about.

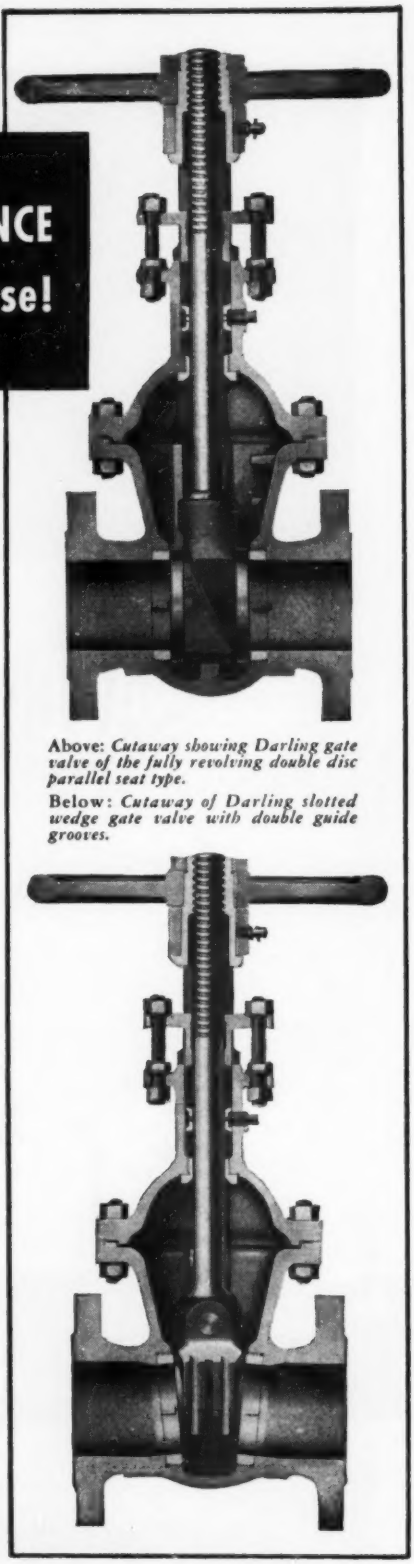
For example, all *Darling* parts are precision-made to jigs and templates. Replacement parts slip in quickly and easily.

What's more, Darling valves are designed so that seat rings and all working parts are easily removed and replaced without taking the valve bodies from the line.

These maintenance and repair advantages, plus many other time-and-money-saving features, apply to Darling gate valves of both popular types shown at right. It adds up to low-cost performance at its over-all *best!* Ask for the Darling Cast Steel Valve Bulletin. Get *all* the facts so you can judge for yourself!

FOR PLUS VALUES, JOB-PROVED AGAIN AND AGAIN

FOR EVERY NEED. *Darling gate valves are made in a wide range of sizes, types and constructions for all kinds of normal and unusual service . . . and for pressures up to 1500 pounds.*



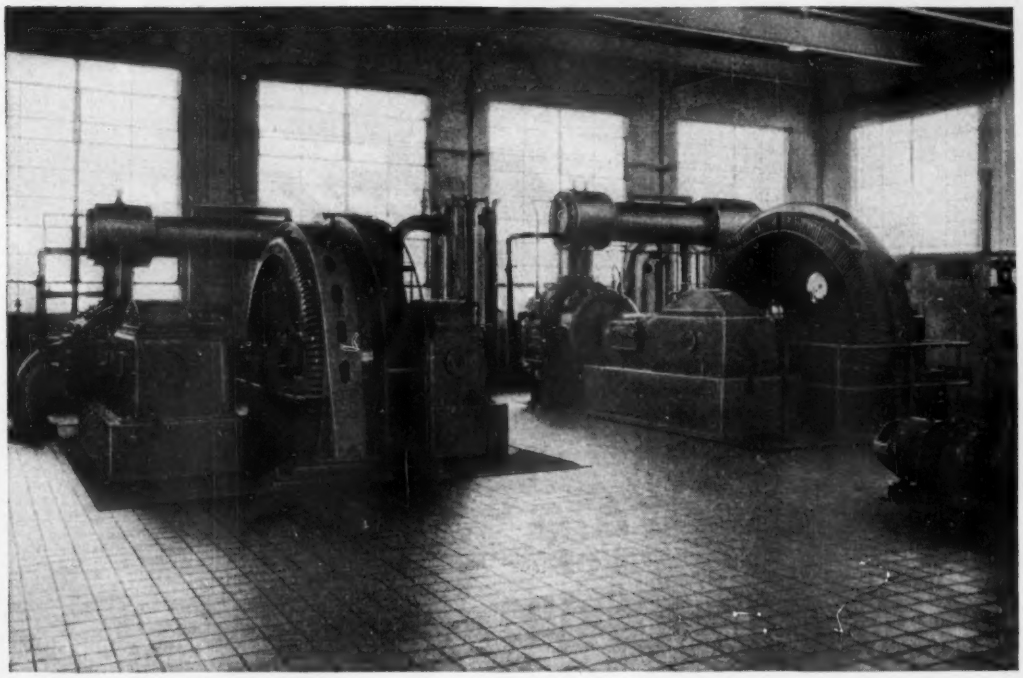
Above: *Cutaway showing Darling gate valve of the fully revolving double disc parallel seat type.*

Below: *Cutaway of Darling slotted wedge gate valve with double guide grooves.*

DARLING VALVE & MANUFACTURING CO.

Williamsport 8, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.



with O-CE COMPRESSORS, built for continuous, heavy-duty operation — in sizes up to 2,000 hp., for pressures to 5,000 lbs.

Of horizontal, double-acting, water-cooled type, with direct-mounted synchronous motor drive, these compressors are unsurpassed for dependable, low-cost performance.

meet AIR DEMANDS economically

- ✓ Equipped with roller bearings throughout.
- ✓ Quick-acting Simplate valves minimize power consumption.
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- ✓ CP Multi-Step Control handles partial load demands economically.
- ✓ CP Automatic Starting Unloader completely unloads compressor when starting and stopping, and permits automatic restarting after power failure.
- ✓ CP Intercooler assures maximum heat transfer with low water consumption.

Write for full information.

Fiftieth ANNIVERSARY

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General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
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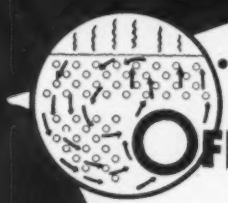
Check First with Dutton

FOR ONLY THE DUTTON ECONOTHERM GIVES YOU OFF-CENTER FIRING



AND ...HERE'S THE EXTRA ADVANTAGE OF OFF-CENTER FIRING

Induces positive, fast water circulation in a rotary motion, resulting in uniform water temperature in shell . . . faster steaming . . . elimination of surging and priming . . . a steady water line at all times . . . higher quality, dry steam . . . and a higher column of water above the furnace. Every point makes sense — makes performance too!

CHECK NOW with DUTTON . . . write for new ECONOTHERM Bulletin EC-1152C.

COMPACT
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SELF-CONTAINED
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FULLY AUTOMATIC
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ROTARY COMBUSTION
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UNUSUAL EFFICIENCY, SAFETY
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GAS, HEAVY OIL, LIGHT OIL FIRING

Other types and sizes — 5 to 250 h.p. See the Yellow Pages in Phone Book for Dutton Representative.

Dutton BOILERS

DIVISION HAPMAN-DUTTON COMPANY

KALAMAZOO, MICHIGAN • BOILER BUILDERS SINCE 1880

engineering...

While we could not hope to duplicate this Springtime magic which Orioles take for granted, Pipe and Tubular Products is, nevertheless, a firm of engineers. Specialists in our own craft of pipe and tube fabrication, our new, larger plant at Catasauqua, Pa., enables our engineers to produce more goods in less time . . . to serve your needs with maximum speed, and at minimum cost.

Pipe and Tubular Products has a wealth of experience in producing bent tubing elements for boilers, condensers and superheaters of carbon, alloy and stainless steels as well as welded tubing and structural fabrication. Recent additions to our plant now add a complete machining department as well . . . and open up channels for increased service to our customers, both new and old.

Service has always been a specialty with us, and we are particularly adapted to supplying tubes for emergency repair work, usually shipping orders the same day on which they are received.

And, like the Orioles above, we, too, often fly our shipments direct to the site.

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INCORPORATED
Tubing P&P *Specialists*

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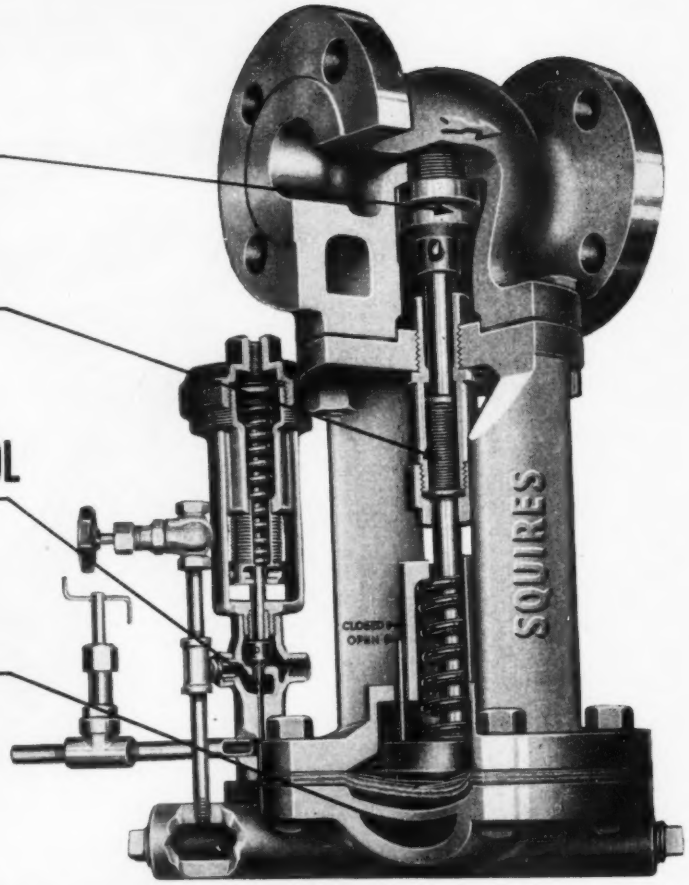
SINGLE SEATED

PACKLESS CONSTRUCTION

PRECISION PRESSURE CONTROL

POSITIVE DEAD-END VALVE



YOU GET ALL IN EACH SQUIRES REDUCING VALVE

These four are a few of the many features that are designed into each Squires Reducing Valve to give you guaranteed reduced low pressure control within one ounce variation.

Single Seat and Disc construction gives accurate flow control to maintain a constant desired reduced pressure. This valve design together with the Squires Patented Diaphragm also gives full opening allowing maximum capacity.

Packless Construction available through 3" sizes, gives frictionless movement for accurate low pressure control. In addition maintenance is minimized for trouble free service.

Precision Pressure Control is constantly maintained through the Patented Squires Pilot—the heart of the reducing valve. Being an outside pilot it allows for ease of adjustment and accessibility to working parts. Pressure reduction can be made from 600 PSI to ounces in one step.

Positive Dead-End Control is guaranteed by the closing force resulting from the magnification of the high pressure on the main diaphragm—giving positive shut off when maximum low pressure is reached. For example on a 1½" valve with 100 PSI initial pressure the dead-end force on the seat is 3,000 pounds—a ton and a half.

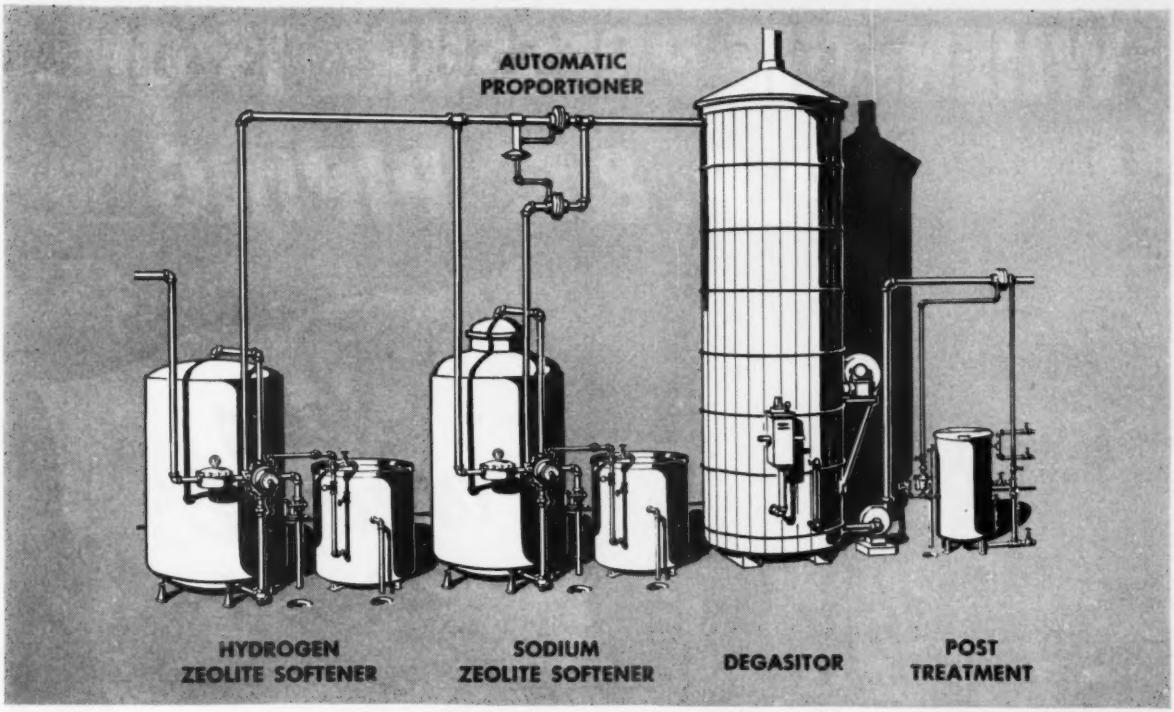
Standardize on Squires Valves—initial investment is low—operation is efficient and trouble-free—maintenance costs are minimized through interchangeability of parts. Get all the facts for yourself about SQUIRES REDUCING VALVES.

Write today and ask for Bulletin #107

THE C. E. SQUIRES COMPANY

Over 50 Years of Dependability

18502 SYRACUSE AVENUE • CLEVELAND 10, OHIO



This Elgin "Split Stream DeAlkalizing" System

Eliminates Boiler Scale, Corrosion, and Excess Alkalinity At Taylor Oil and Gas Company

Taylor Oil and Gas Company, Corpus Christi, Texas is one more in a long list of well known firms that have selected Elgin Water Conditioning for their exacting requirements.

With the system graphically illustrated above, blended effluents from sodium and hydrogen zeolite water softeners, followed by degasification, give zero soft water in which total solids and alkalinity is reduced and CO_2 is removed. Boiler water alkalinity is kept in proper proportion to total dissolved solids. The dissolved solids have been reduced 34.5%. (On waters of higher alkalinity, a greater reduction is obtained.) Blowdown is reduced approximately 35%. Think how much this alone saves. Costly destruction resulting from return line corrosion is prevented. And as an extra dividend, post-treatment costs are cut to a minimum.

A Complete Line To Meet Your Specific Needs

This is but one of our many water conditioning systems. We make all types, ranging from the outstanding "Double-Check" zeolite water softener which gives up to 44% more soft water, to the Ultra-DeIonizer which produces water of the highest known chemical purity.

Write for details or let us put our nearest representative in touch with you.

Representatives in Principal Cities

THIS CHART TELLS THE STORY

WATER CONSTITUENTS	RAW WATER Gr/Gal	TREATED WATER Gr/Gal
Carbonate (Alkalinity)	4.95	0.73
Sulfate	3.15	3.15
Chloride	4.08	4.08
Calcium	3.04	0.03
Magnesium	0.42	0.02
Sodium	3.66	4.68
Total Dissolved Solids	19.30	12.69
Reduction in Dissolved Solids		**34.5%**

Why Not Obtain Comparable Improvement in Your Boiler and Process Water?

ELGIN
SINCE 1908
WATER CONDITIONING
FOR EVERY NEED

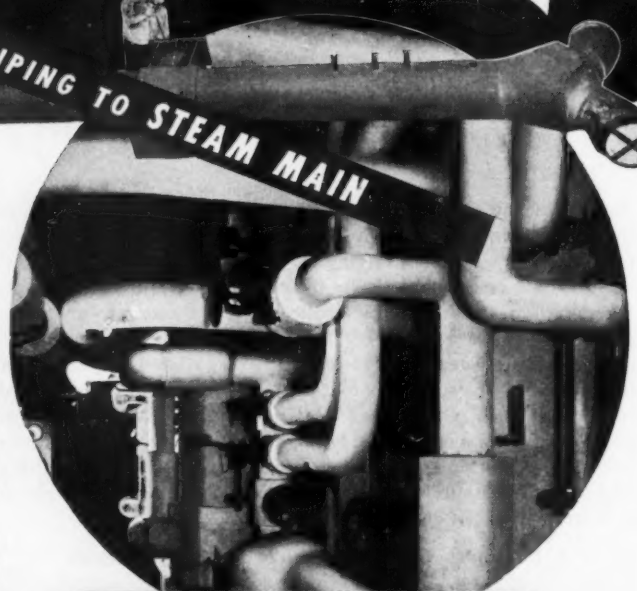
ELGIN SOFTENER CORPORATION • 130 North Grove Avenue, Elgin, Illinois

In Canada: G. F. Sterne & Sons, Ltd., Brantford, Ontario

WHEN THE PRESSURE IS ON P.P.&E. PIPING

has what it takes

FROM CONTROL PIPING TO STEAM MAIN



Today's 1000°F and higher temperatures, combined with pressures in the 2000 psi range—really "put the pressure" on a piping system. It could be said that these higher, and perhaps even higher pressures to come, will force new standards of piping.

But—remember when 750°F was considered to be a high reheat temperature? Even then, P.P.& E. was ahead of the needs in piping to carry the load. As the trend toward higher temperatures continued—P.P.& E. has kept ahead of the requirements.

That's why conditions encountered in present-day reheat temperatures are thoroughly understood by P.P.& E. engineers—and why adequate materials, design know-how, methods of treating and fabricating, and testing procedures are available.

When the "pressure is on" you can depend on every part of a P.P.& E. piping system—from the steam main, right down to the air lines.

Pittsburgh Piping

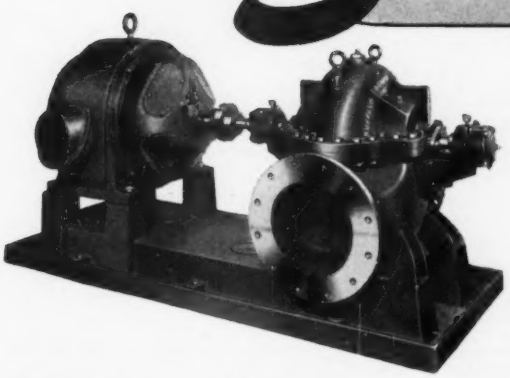
AND EQUIPMENT COMPANY

10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Whitehead Building, Atlanta
Book Tower, Detroit
785 Market Street, San Francisco
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston

"Buffalo" Tips on Better Pumping

3 TYPES of PUMPS and what each offers you —

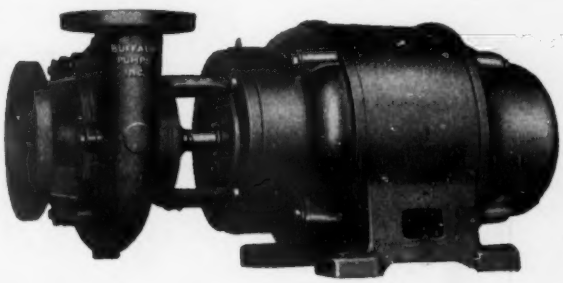


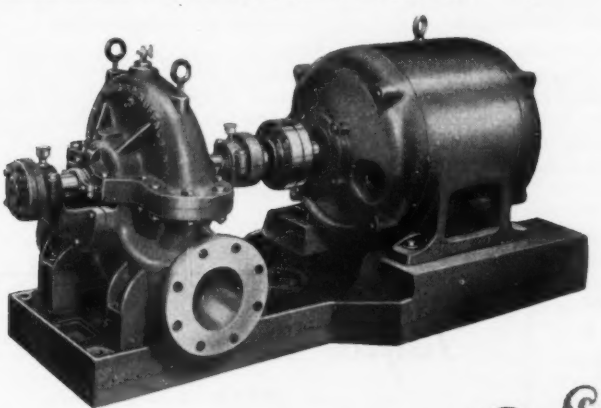
1. DOUBLE SUCTION

This "Buffalo" Pump offers a high degree of efficiency in pumping large volumes of clear water. Available in capacities for 10 to 10,000 gpm at up to 300 ft., these pumps are hydraulically balanced—water entering both sides of the impeller in equal volume and pressure. Bearings on each end of shaft mean extra long wear. Horizontally divided casing makes for extreme accessibility in inspection and servicing. Full details in BULLETIN 955-P.

2. CLOSE-COUPLED

Here is a ruggedly compact pump for those "close-quarters" installations. Pump and motor are rigidly mounted together with impeller on motor shaft, which means *permanent alignment.* "Buffalo" builds these pumps in a variety of alloys for specific liquids, with threaded or flanged inlets and outlets. Pump casing may be rotated, or removed for inspection—an important maintenance factor. WRITE for BULLETIN 975-B.





3. MULTI-STAGE

Each extra stage adds pressure! That's why pumps like these "Buffalo" Type "RR" (2 and 4-stage models) operate efficiently against high pressures (500 psi or 1500 ft. heads). These "Buffalo" Pumps have proven themselves very durable in boiler feed and other clear water installations. Bearing support on both ends of the shaft—rugged, horizontally divided casing—solid, rigid base—all contribute to easy maintenance and long life. For further details, write for Bulletin 980-B.

BUFFALO "Buffalo" PUMPS, INC.

488 BROADWAY BUFFALO, N. Y.

Subsidiary of Buffalo Forge Company

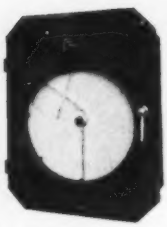
Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

WHICH ONE OF THESE TAYLOR INSTRUMENTS WILL SAVE YOU THE MOST ?

RECORDING FULSCOPE* CONTROLLER

For desuperheaters, or for any close, accurate control of temperature, pressure, flow or liquid level. Quickly adapted to operating requirements.

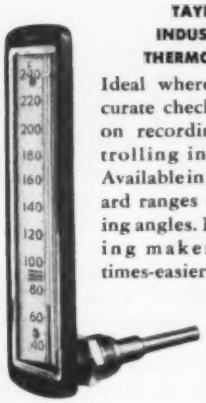


RECORDING THERMOMETER OR PRESSURE GAUGE

Ideal wherever you need a record of pressure, temperature or a combination of both. For example, accurately records steam and feed water temperatures and pressures, or oil, air and flue gas temperature.

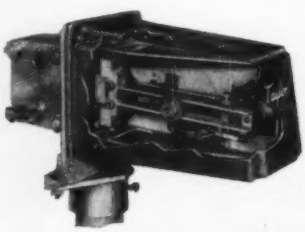
NEW 6" DIAL INDICATOR

For temperature and pressure measurements. Has an all-new design movement for greater sensitivity on any type of measuring job. New case can be flush or face mounted, is fume and moisture proof. Big selection of standard ranges.



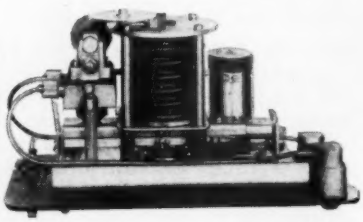
TAYLOR INDUSTRIAL THERMOMETER

Ideal wherever an accurate check is needed on recording or controlling instruments. Available in many standard ranges and mounting angles. BINOC* tubing makes it three-times-easier-to-read.



TAYLOR TRANSAIRE* DIFFERENTIAL PRESSURE TRANSMITTER

A rugged, dependable and accurate instrument designed to measure flow, liquid level or specific gravity. Taylor's latest addition to Transet System of transmitters, receivers and controllers.



TAYLOR TRANSAIRE TEMPERATURE TRANSMITTER

Compact, super-responsive, designed to measure and transmit smallest temperature changes up to 1,000 feet with great accuracy. Provides dynamic accuracy, thanks to derivative action in the measuring circuit.

ANY ONE of these instruments can help you cut costs and increase efficiency. From a single thermometer to the complete TRANSET* Pneumatic Control System, Taylor has the answer to many power plant problems. Why not ask your qualified Taylor Field Engineer, or write for full information as to how we can help you. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

*Reg. U. S. Pat. Off.

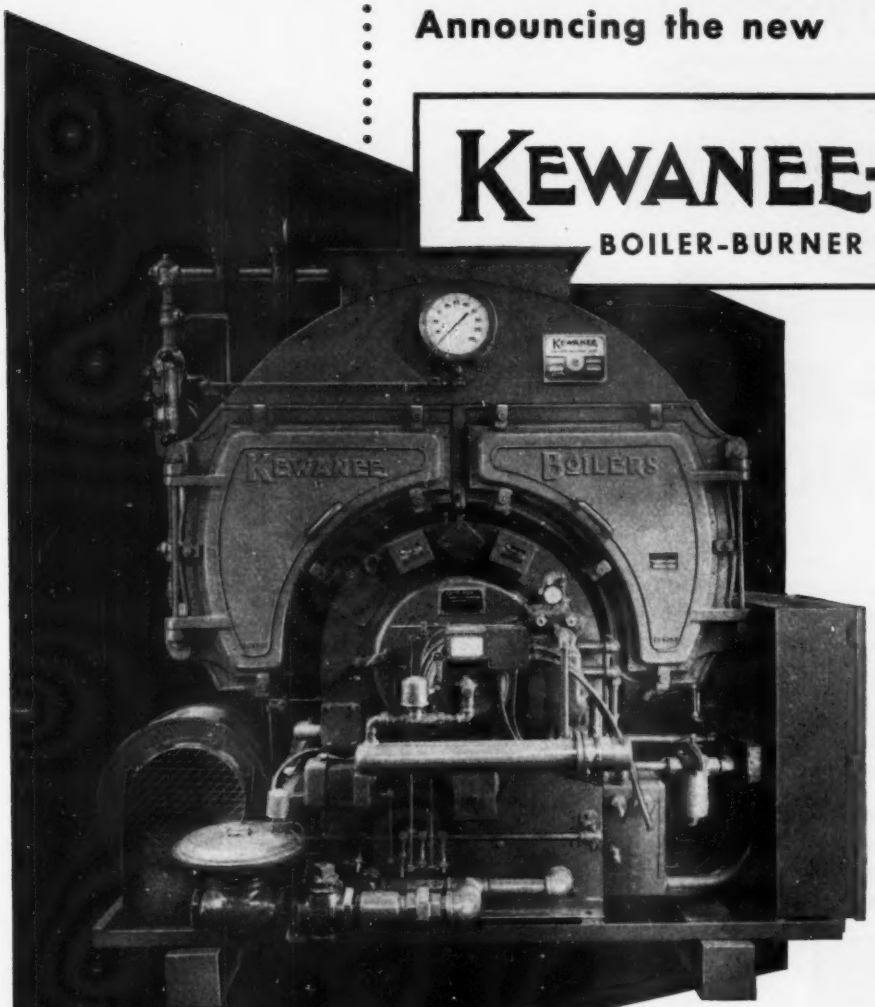
Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

Announcing the new

KEWANEE-RAY

BOILER-BURNER UNIT



For Oil, Gas or
Combination Gas-Oil

BOOSTS EFFICIENCIES IN ALL FIRING RANGES

Now . . . the Ray Combination Oil-Gas Burner and the Kewanee Scotch type Boiler . . . built to specifications that completely integrate each with the other . . . provide a unit developing high efficiencies throughout the entire firing range.

These higher efficiencies are made possible by the revolutionary new *multi-stage secondary air control,* on the burner, which produces higher flame temperatures in the combustion chamber. And these high efficiencies are maintained even when the unit is operated at 50% and more beyond its rated capacity.

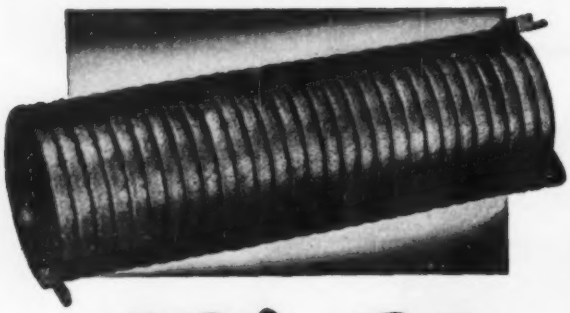
Kewanee-Ray Boiler-Burner Units are built for *both* High and Low Pressure Steam and for Hot Water Heating. 11 sizes—52 to 456 horse power; 125 and 150 lbs wp. . . . 13 sizes for 15 lbs steam or 30 lbs water from 1,313,000 to 10,200,000 Btu.

For complete information see your local Ray or Kewanee Representative

RAY OIL BURNER CO.
1301 San Jose Ave., San Francisco, Calif.

KEWANEE-ROSS CORPORATION
101 Franklin St., Kewanee, Ill.

Super Efficient



SEA-RO
NEK-SEAL PACKING

CENTRIFUGAL AND RECIPROCATING PUMPS will give longer, smoother service when SEA-RO NEK-SEAL Packing No. 501 is specified. Here is a pump packing that has proved its super efficiency on both industrial and marine installations. Once installed it forms a fine bearing surface and gives steady, reliable, trouble-free service. Wear on rods is reduced to a minimum because of the lubricating qualities of the packing. It is practically a permanent packing when properly installed.

For EXTREME high speeds and high pressures, SEA-RO ARMORED — NEK-SEAL combination sets are recommended for maximum efficiency.

What is the "NEK-SEAL"

It is an inlaid fillet of lead antimony alloy which forms a perfect anti-frictional seal of bushing clearances. It is an EXCLUSIVE patented process.

- **Power loss and blow-by are eliminated.**
- **Prevents packing being forced into cylinder.**
- **Increases strength and resiliency of packing itself.**

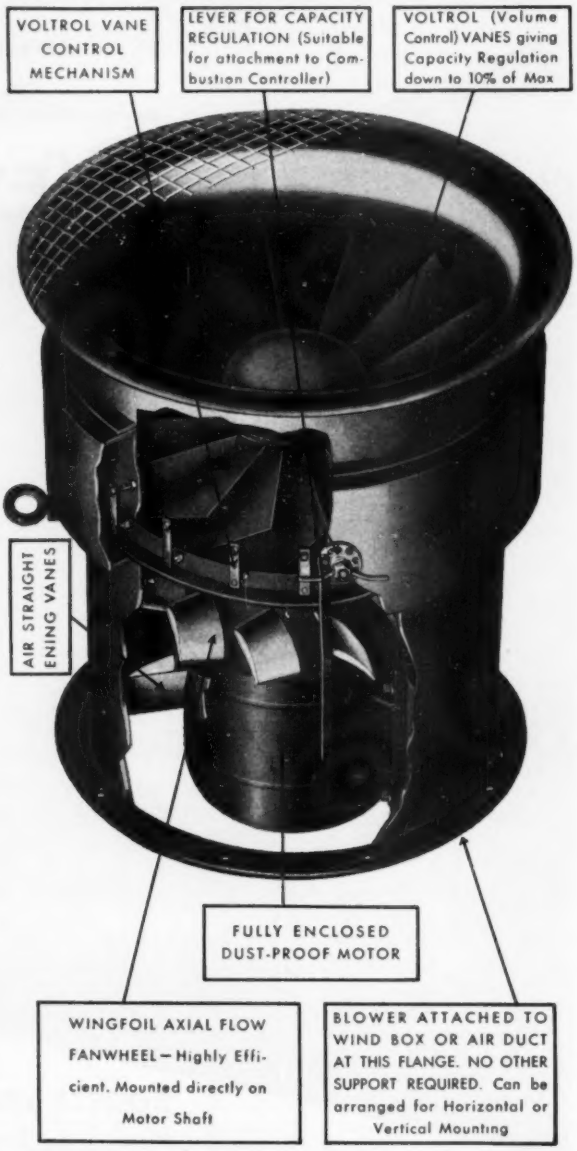
Consult our engineering department about your pump packing problems. Send for catalog of products and engineering data.

Industrial sales territories open for qualified agents

SEA-RO — NEK-SEAL PACKING, PUMP PLUNGER RINGS

SEA-RO PACKING CO., INC. • WOOD-RIDGE, N. J.

WING Type EMD BLOWER


VOLTROL VANE CONTROL MECHANISM
LEVER FOR CAPACITY REGULATION (Suitable for attachment to Combustion Controller)
VOLTROL (Volume Control) VANES giving Capacity Regulation down to 10% of Max
AIR STRAIGHTENING VANES
FULLY ENCLOSED DUST-PROOF MOTOR
WINGFOIL AXIAL FLOW FANWHEEL — Highly Efficient. Mounted directly on Motor Shaft
BLOWER ATTACHED TO WIND BOX OR AIR DUCT AT THIS FLANGE. NO OTHER SUPPORT REQUIRED. Can be arranged for Horizontal or Vertical Mounting

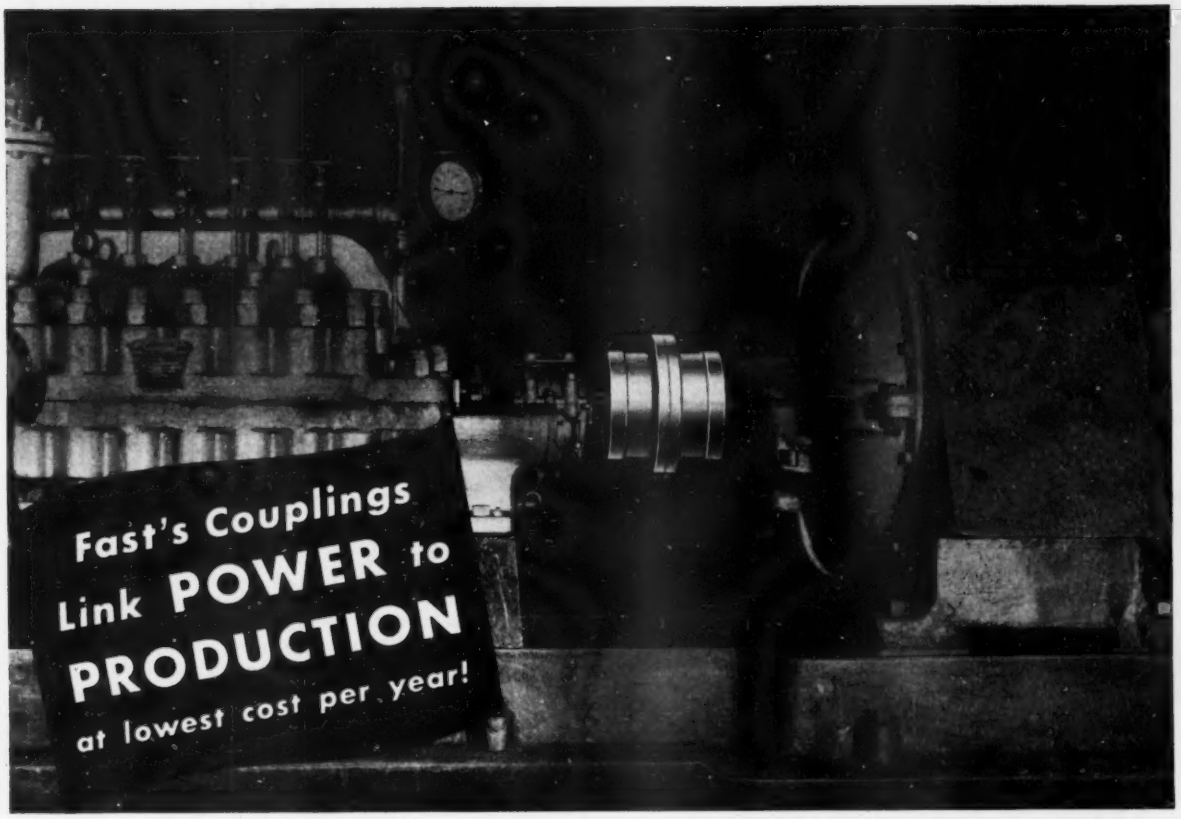
Wing Blowers can be furnished in Single Stage (Type EMD) as shown above, or in Two Stage (Type COM), where the second fan would be mounted on the other end of the motor.

L. J. Wing Mfg. Co. 50 Vreeland Mills Rd. Linden, New Jersey

Offices in Principal Cities of U.S. & Canada

Wing

AXIAL FLOW FORCED DRAFT BLOWERS



Over half a million FAST'S Couplings now in use!

THROUGHOUT industry, Fast's are rated the most dependable couplings on the market... to the tune of over half a million now in service! Year in, year out, they continue to *outlast the equipment they connect* . . . save time, maintenance and money by eliminating costly coupling failures.

Actual cases on record show many Fast's Couplings have been in operation for 25 and 30 years without trouble. And every major producer of high-speed equipment now uses Fast's!

Solve your coupling worries! Write today for full details on Fast's Couplings and Koppers Engineering Service to: KOPPERS COMPANY, INC., *Fast's Coupling Dept.*, 221 Scott St., Baltimore 3, Maryland.

Here's How FAST'S Save You Money

Free Service—Koppers free engineering service assures you the right coupling for the job.

Rugged Construction—Fast's still maintains its original design, without basic change or sacrifice in size or materials. Result: freedom from expensive coupling failures.

Lowest Cost per Year—Fast's Couplings usually outlast equipment they connect. Their cost may be spread over many years!

KOPPERS®

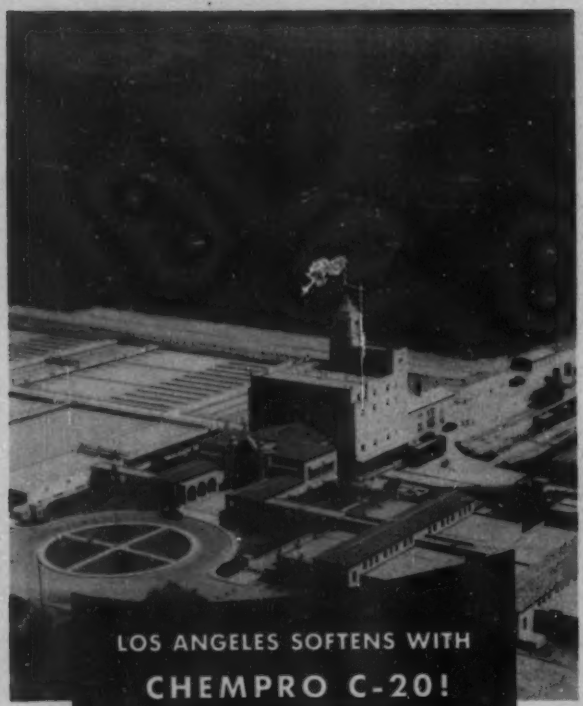
FAST'S
THE ORIGINAL
GEAR-TYPE
Couplings

INDUSTRY'S STANDARD FOR 32 YEARS

KOPPERS COMPANY, INC., *Fast's Coupling Dept.*
221 Scott St., Baltimore 3, Md.

Gentlemen: Send me Fast's Catalog which gives detailed descriptions, engineering drawings, capacity tables and photographs.

Name .....
Company .....
Address .....
City ..... Zone ..... State .....



LOS ANGELES SOFTENS WITH

CHEMPRO C-20!

Shown above is the new water softening and filtration plant of the metropolitan water district of Southern California.

The plant, designed to soften Colorado River water for the use of Los Angeles area residents, has a total planned capacity of 400,000,000 gallons of water per day.

Chempro C-20 polystyrene cation exchange resin is the major ion-exchange resin in the softening units.

Other resins developed especially for water treatment include Duolite A-7 (anion exchanger for demineralization) and Duolite A-41 (anion exchanger for silica removal).

WRITE TODAY . . for FREE booklet outlining facilities of Chemical Process Company and list of anion and cation exchange resins available for water treatment.

DUOLITE® ADSORBENT RESINS

CHEMICAL PROCESS COMPANY

REDWOOD CITY CALIFORNIA

Kittell Silencers and Spark Arrestors . . .

IMMEDIATE DELIVERY!

Efficient, low-cost, heavy-duty units that stop damaging back surge . . . reduce engine noise to a whisper!

A COMPLETE LINE . . .

SILENCERS (steel, stainless steel, ceramic coated)
Exhaust
Air discharge
Steam discharge
Water-type
Jet
Heat-recovery

SPARK ARRESTORS (steel, stainless steel, ceramic coated)
Dry centrifugal
Water-type

FOR EVERY USE . . .

- Gas and diesel engines
- Steam generators
- Drilling rigs
- Pumping units
- Generator sets
- Compressors & blowers
- Boats and ships
- Heavy construction equipment
- Trucks and buses
- Logging and mining machinery

Specific purpose units can be manufactured to your specifications. Send for complete catalog today.

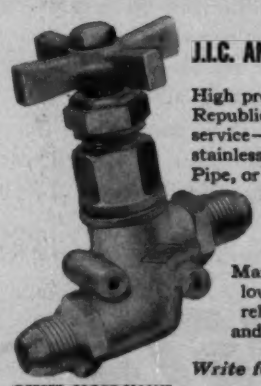
Kittell Muffler & Engineering, Inc.

915 SOUTH SANTA FE AVENUE, LOS ANGELES 21, CALIFORNIA

REPUBLIC

VALVES

INDUSTRIAL • CHEMICAL • AIRCRAFT



OFFSET GLOBE VALVE

J.I.C. AND AN STANDARD TUBE ENDS

High pressure needle and globe valves by Republic have forged bodies for super duty service—brass, steel, aluminum alloy, or stainless steel. Exclusive design features. Pipe, or AN or J.I.C. tube ends, or combinations, sizes ⅛" to 1". Operating range: needle—3,000 psi; globe—2,000 psi, –65° to 350°F.

Manufacturers also of high quality low and hy-pressure check valves, relief, 2, 3, and 4-way plug valves, and special valves to specifications.

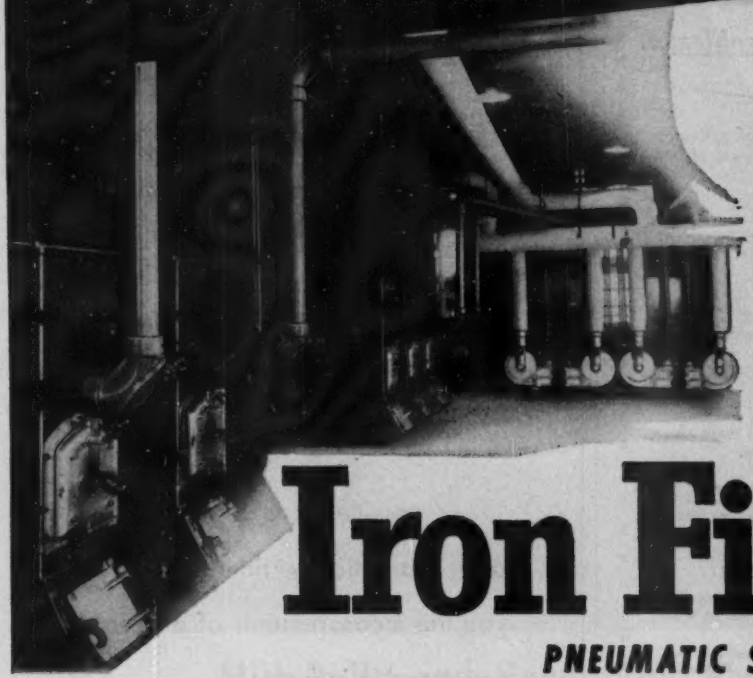
Write for complete catalog and name of nearest distributor.

82

REMCO REPUBLIC MANUFACTURING CO.

1930 WEST 77TH STREET • CLEVELAND 2, OHIO

Burns either Coal or Wood Waste



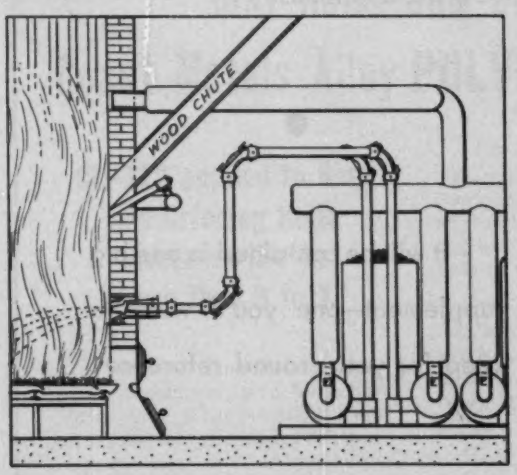
Iron Fireman coal stokers enable Bassett Furniture Industries to utilize wood refuse as fuel

These Iron Fireman Pneumatic Spreader stokers pick up the load automatically the moment the supply of wood refuse runs out. They enable the company to use wood waste as a primary fuel. Only enough stoker coal is burned to maintain a uniform steam supply.

Iron Fireman automatic air control and exclusive air-cooled grates give top firing efficiency with both fuels. Stokers are installed in six boilers, each with a capacity of 40,000 lbs. of steam per hour, which carry the power load for the various Bassett factories.

Iron Fireman

PNEUMATIC SPREADER COAL STOKERS



Coal is thoroughly dried and preheated before it is conveyed pneumatically to furnace grates. The distributor nozzle spreads the dry coal over the *entire* grate in a shallow, uniform fuel bed. Preheated fines burn in suspension, reducing cinder carryover and greatly improving combustion efficiency and responsiveness as compared with stokers which do not preheat coal. Wood waste is fed through chute at upper right.

You save three ways when you install an Iron Fireman Pneumatic Spreader stoker. You save on installation costs, you save on labor costs, and you save on fuel costs. This outstanding coal firing system dries, preheats, conveys and fires the coal. Manual coal handling is completely eliminated. Coal is piped directly from bunker to fire, doing away with the costly coal handling equipment usually required.

The Iron Fireman Pneumatic Spreader stoker burns a wide range of coals, including low ash fusion, sub-bituminous and lignite—ranging from one fourth inch slack to two inch top size. Readily adaptable to any boiler room layout. Capacities available to 1,000 boiler horsepower in single units; multiple units for larger capacities.

Dual and Triple Fuel Firing

While Iron Fireman stokers are often used in conjunction with the firing of wood waste, they are also readily combined with Iron Fireman oil and gas burners. The ability to shift fuels quickly will protect your plant against fuel shortages and permit advantageous buying of fuel. Send for descriptive literature.

Coal, Gas, Oil firing equipment for heating, processing, power

THE IRON FIREMAN

IRON FIREMAN MANUFACTURING COMPANY
3041 West 106th Street, Cleveland 11, Ohio.
Send me literature on the Iron Fireman Spreader Stoker.

Name _____

Address _____

City _____ State _____

6 Essential Facts

for a company with a Water Problem...

1. Costs Far Less to Install!

A Ranney Water Collector will add millions of gallons to your daily water supply—at a fraction of the cost of conventional systems!

2. Less Expensive to Operate!

A Ranney Water Collector is far less expensive to operate—uses fewer pumps, fewer personnel, less power, and usually requires no treatment facilities.

3. Maintenance Requirements Practically Nil!

A Ranney Water Collector requires little or no maintenance. The rate of flow through the Ranney Collector's apertures eliminates clogging and silting. No filter plant maintenance.

4. More Water per Unit!

A single Ranney Water Collector has produced more clear, cool water than ten conventional vertical wells.

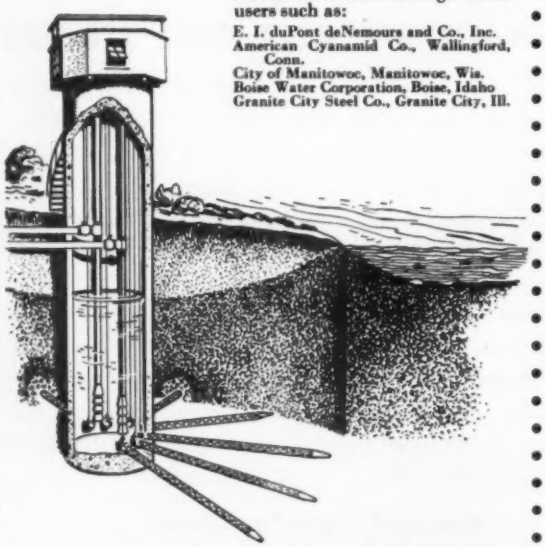
5. Far Longer Life Cuts Depreciation Costs!

The longer life of a Ranney Water Collector lowers financing and depreciation rates appreciably.

6. Ask These Satisfied Users

Ranney Water Collectors are currently rendering excellent service to scores of large water users such as:

E. I. duPont deNemours and Co., Inc.
American Cyanamid Co., Wallingford, Conn.
City of Manitowoc, Manitowoc, Wis.
Boise Water Corporation, Boise, Idaho
Granite City Steel Co., Granite City, Ill.



An inexpensive Ranney survey will determine how the Ranney Method can work for you.

If you need water, write us for complete information on how a Ranney Water Collector will solve your problem.

Ranney Method Water Supplies, Inc.

HYDROLOGISTS AND WATER SUPPLY CONTRACTORS

Executive and Engineering Offices
Dept. E1, P.O. Box 277, Columbus 9, Ohio

Power

announces a new service for its readers:

●

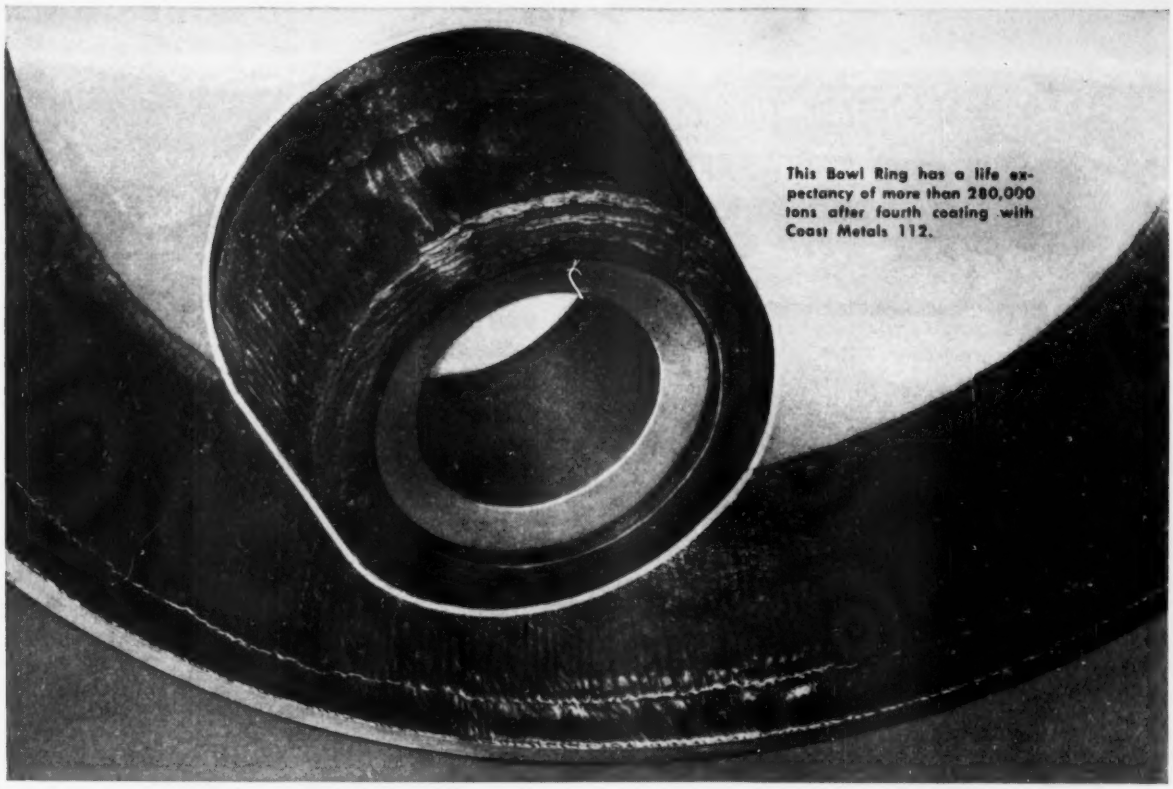
—a service carefully planned and dramatically timed to give you the measurements of a great new trend in industry

●

—it will be contained in one big supplement—one you'll want to keep for year 'round reference

●

Details will be announced in the February issue of Power



This Bowl Ring has a life expectancy of more than 280,000 tons after fourth coating with Coast Metals 112.

Mill Rolls and Bowl Ring Hard-Faced with Coast Metals Alloy PULVERIZES 210,000 TONS OF COAL

CM-112 applied to Ring and Grinding Rolls increases life by more than 3 to 1

The Bowl Ring pictured above was photographed at a large Ohio utility plant. It has pulverized a total of 210,000 tons of coal, at 100% rated capacity, on 3 separate hard-facings with Coast Metals Alloy 112. A fourth facing, now being applied, will give this unit a life expectancy of at least 280,000 tons.

Life of uncoated rings at this Ohio plant is about 65,000 tons, after which they must be replaced. Efficiency drops off sharply after approximately 30,000 tons and the result is that production costs of remaining tonnage run high.

The history of this ring, therefore, clearly illustrates the tremendous advantages gained by Coast Metals hard-facing—proves that hard-facing with CM Alloys *pays off in a big way.*

There are many other examples of how CM Alloys extend the life of parts subject to impact, abrasion, and high heat during operation: Bowl mill deflector castings and sideliner wear plates—ring retainer lugs—coal feeder screws—sluice liner castings—clinker crusher rolls—ID fan float liner plates—exhauster fan blades and impact mill plows, when hard-faced with CM *stay on the job* and continue to perform efficiently *long after* unfaced parts have become too worn to use and must be replaced.

Holding down production and maintenance costs has never been so important as it is today. So don't *replace—reface* with CM specialized weld rods. You'll not only keep production running smoothly, but save money. We shall be glad to make recommendations based upon your particular needs.

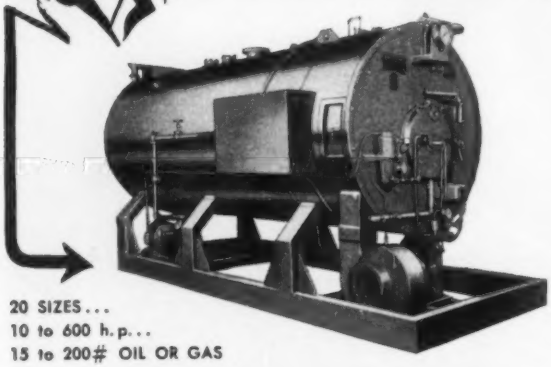
COAST METALS, Inc.

Little Ferry, N. J.

COAST METALS (CANADA), LTD., Hamilton, Ontario

PRODUCERS OF SPECIAL HARD-FACING ALLOYS FOR THE POWER INDUSTRY

No Annoying "Extras"
IT'S READY TO INSTALL
AND START MAKING
Low-Cost Steam!



20 SIZES...
10 to 600 h.p...
15 to 200# OIL OR GAS

AMESTEAM GENERATOR

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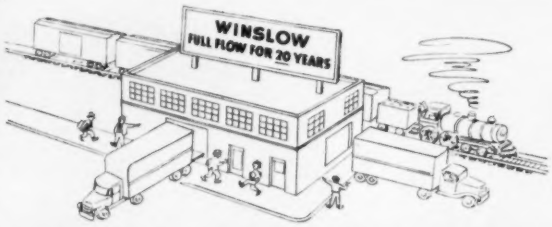

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Fig. 1561 W. E.—150-pound Cast Steel Swing Check Valve with welding ends and bolted cap.

Fig. 1314-A—1500-pound Steel Integral Bonnet "Y" Valve with socket weld ends. Sizes ½" to 2", incl.

Fig. 1793—Large 125-pound Iron Body Bronze Mounted Gate Valve with outside screw rising stem, bolted flanged yoke and tapered solid wedge.

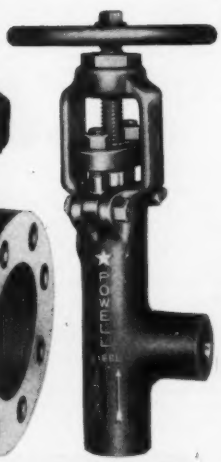

Fig. 1333-A—Steel Integral Bonnet Angle Valve for 1500 pounds W. P. Socket weld ends. Sizes ½" to 2", incl.

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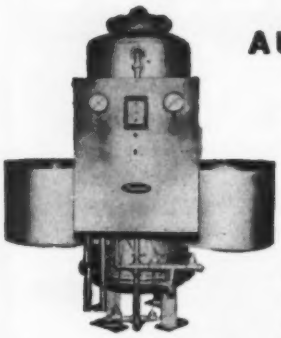

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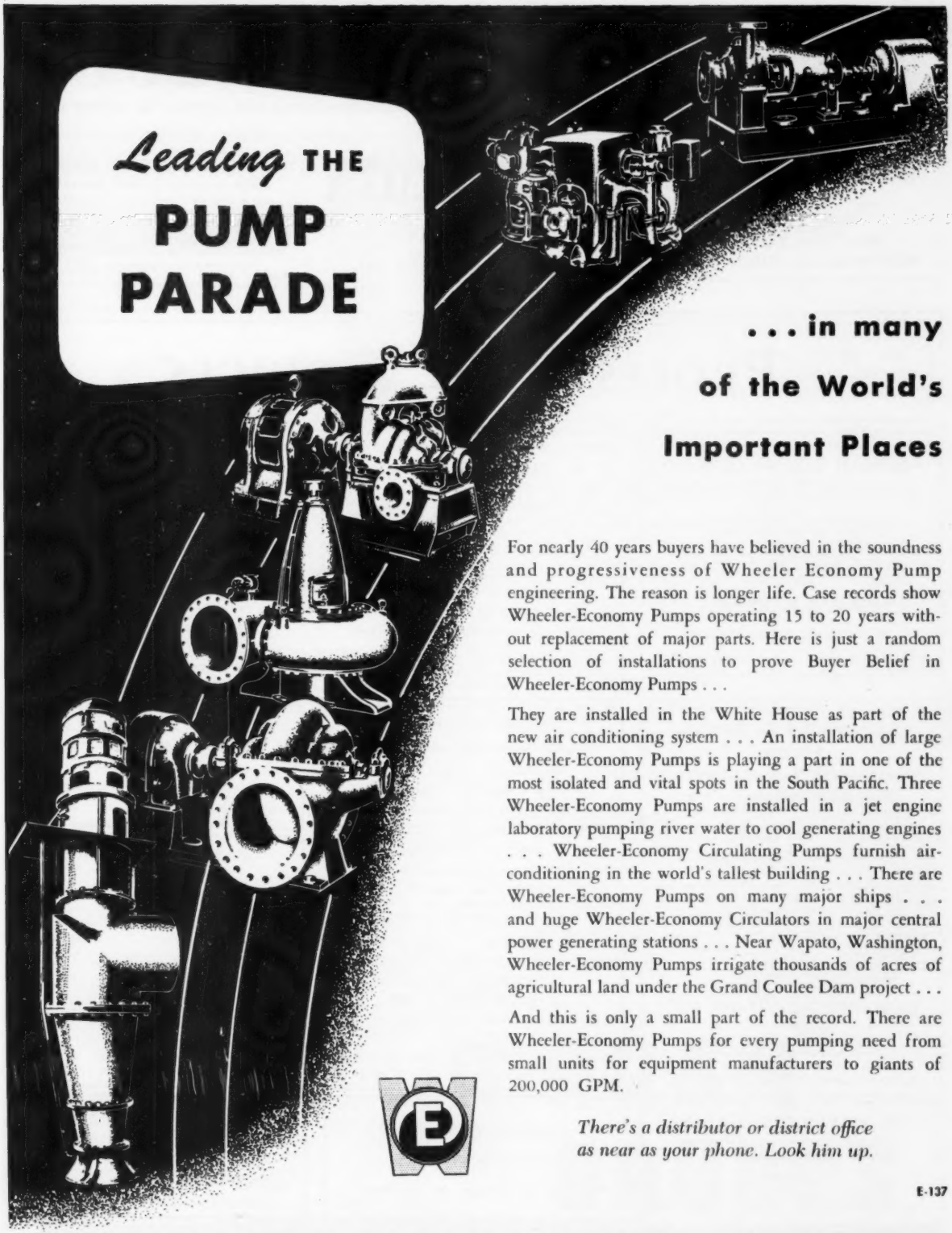

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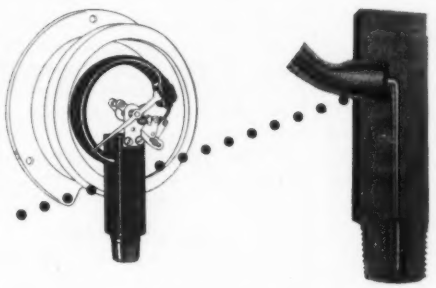

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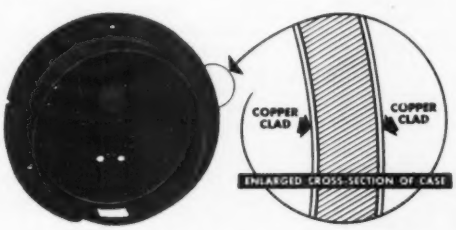

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(Additional Positions Vacant Ads on opposite page)

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CHIEF ENGINEER for steam electric plant in large transmission company, fully experienced in modern power plant operation using gas and oil for fuel. Permanent opportunity for thoroughly qualified man to take complete charge. Must be a master mechanic. P-6325, Power.

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P-6286, POWER
330 W. 42nd St., New York 36, N. Y.

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SALARIED PERSONNEL. $3,000-$25,000. This confidential service established 1927 is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 241 Orange St., New Haven, Conn.

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MECHANICAL ENGINEER—Graduate; 7 years' experience with boiler manufacturer; 2 years operating large industrial steam plant; and 16 years in fuel business in combustion, sales, management. Looking for more responsibility with consulting engineers or large industrial. PW-6298, Power.

SUPT., ASST. Supt. of Chief Engr. position. Ten. yrs. of steam, steam-elect. plant experience. Educated, but possess no degree, age 32, married, four children. Presently Supt. of medium size City power plant. Good reason for seeking change. Desire South or Mid-West. PW-6299, Power.

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TWO SALES Engineer want power or industrial process account for Phila. and 60 mile radius. SA-6319, Power.

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Notice is hereby given that sealed bids will be received at the office of The Board of Trustees of Public Affairs of the Village of Tipp City, Miami County, Ohio, until twelve o'clock noon on the 30th day of January, 1953, for the sale of the following described personal property:

One (1) single cylinder, 250 horsepower, horizontal Ames uniflow steam engine designed to operate on 150 psi saturated steam with 0-5 psi back pressure. Bore 19", stroke 20", 225 rpm. Engine is direct connected to a 210 kva, 2300 volt, 80% powerfactor, General Electric generator. Exciter is V belt driven from end of generator shaft. Unit is complete with all accessories including switchboard and voltage regulator and is in good condition.

One (1) Turbo-Generator set consisting of a Westinghouse Turbine direct connected to a Westinghouse Generator and having a separately driven Exciter set consisting of an Elliott steam turbine driving an Elliott Exciter. The main unit is designed for 150 psi steam pressure and 1½" Hg back pressure, 2300 volts, 80% powerfactor, 1250 kva, 3600 rpm. The Exciter set is designed for 150 psi steam pressure and 0-5 psi back pressure and runs at 3600 rpm. The entire unit is complete with condenser, pumps, air ejector, switchboard, voltage regulator, etc., and is in good condition.

Both units are now in service and can be seen running if so desired. If sold, said units are in no way to be made inoperative until the successful completion of the expansion project now underway at our Municipal Light and Power Plant.

Said property is to be sold and conveyed to the highest bidder by proper Bill of Sale upon the following terms: CASH.

The highest and successful bidder will be required to make a minimum deposit of 10% of the bid price upon acceptance of said bid. The remainder of the purchase price shall be paid at the time title is transferred to bidder. All payments or deposits shall be in cash monies or certified check, said check being on a bank acceptable to the Village of Tipp City.

Each bid shall be contained in a sealed envelope and plainly marked on the outside as "Bid on Machinery".

Bids may be for either or both units and the right is reserved to accept bids in whatever combination will effect the greatest sale price for the two units.

The right is reserved to reject any or all bids and to waive any irregularity in the form of bidding.

Said bids taken under authority of Ordinance No. 729, dated November 17, 1952.

By order of The Board of
Trustees of Public Affairs
Phyllis Giesseman, Village Clerk

GET 2nd ENGINEER PAPERS IN 1 YEAR

(Yes, get better stationary engineers License!)

No correspondence school bother. Nationally-known Chief Stationary Engineer Frederick C. Walker's 100-Question, 100-Answer Bulletins give you the straight dope quick. Send $3 to Walker & Collins, 526 Ashland Ave., Buffalo 22, N. Y. for first set today. Keep working. Save year.

Your inquiry will have special value . . .

if you mention this magazine, when writing advertisers. Naturally, the publisher will appreciate it . . . but, more important, it will identify you as one of the men the advertiser wants to reach with this message . . . and help to make possible enlarged future service to you as a reader.

CASH FOR SURPLUS

MOTORS
GENERATORS
TRANSFORMERS
COMPRESSORS

WORLD'S LARGEST INVENTORY

See our other ads on pages 278, 283

ELECTRIC EQUIPMENT CO.
ROCHESTER, N. Y.

BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES

No lengths too long or too short
TELEPHONE: EASTGATE 7-4778

PIERCE CABLE CO.
2668 CLYBOURN AVE., CHICAGO 14, ILLINOIS

WANTED

2—600 or 700 H.P. 2300/3/60 slip ring or synchroneous with control speed 200 or 300 RPM 277 preferred.

Diesel engine generator sets 550/3/60 approximately 500 H.P. used or new.

SOUL CLINIC INC., Calgary, Alta, Canada

Idle or obsolete equipment purchased, dismantled & removed.

(We can dismantle anything made of metal)
Men—Tools—Insurance—35 years experience

G. M. LINDER
40-18 216 Street Bayside 61, N. Y.
Telephone BAyside 9-2121

FOR SALE

NO. 30 WELDED
PREMIER BOILER

By Combustion Engineering 150 pounds pressure with Skelly Stoker and No. 550 Prat-Daniel Stack, new July 1949, excellent condition, reasonable price.

CARPENTER & PATERSON, INC.
1190 Bennington St., East Boston 28, Mass.
Telephone No. East Boston 7-0718

FOR SALE

TERRY TURBINE 327 HP type GAZF 2 lbs. gage 28" vacuum 6060 RPM. 30#/BHP/HR. Original crate.

A. R. ANDERSON
768 Fifth Ave., NYC 19 PLaza 9-3000 Ext. 142

FOR SALE

Murray Auto-Extraction Turbo-Generator 150 KW, 80% PF, 220 V, 3 PH. Speed 4015, 1200. Pressure 200—PSIS, Ext. 10 PSI, Condensing Condenser, armatures & Switch Board.

J. FRED SCHMIDT PACKING CO.
253 E. Kossuth St., Columbus 6, Ohio

TWO B 18 STRONG SCOTT COAL MILLS

Serial Nos. 4648 left hand and 4649 right hand. Rated capacity 2000 lbs. per hour. One lot new spare parts for above.

LOUISVILLE CEMENT CORP.
SPEED, INDIANA

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NEW ADVERTISEMENTS, N. Y. Office, 330 W. 42nd St., N. Y. 36, N. Y., for the February issue closing January 9th

ASSISTANT OFFICE ENGINEER

Recent electrical engineering graduate with some practical experience in office work and procedure, for work large Copper Company Chile, South America. 3-year contract.

FIELD ELECTRICAL ENGINEER

Whose duties would be to supervise the work done by the District Electrical Foreman in the various camps. This applies to the Plant with its auxiliary services and covers power distribution and utilization, but in general not power generation or transmission, large copper company Chile, South America. 3-year contract.

Transportation both ways and salary while traveling paid by Company.

In reply give complete details.

P-6065, POWER
330 W. 42nd St., New York 36, N. Y.

FUEL SPECIALIST

Established firm of consulting engineers has opening on its consulting staff for experienced technically qualified Fuel Specialist conversant with solid, liquid and gaseous fuels used in large steam electric generating plants; sources, characteristics, etc. Competent to make studies of comparative economics; determine market possibilities; determine trends as to costs. Also assist selection plant sites as sources and economic worth of fuels relate to selection. Utility background desirable. Give full particulars, education, experience and personal information.

P-6282, POWER
330 W. 42nd St., New York 36, N. Y.

POWER PLANT ENGINEER

Large consulting engineering firm has staff position open for experienced engineer with utility background to engage in system planning studies, economic comparison of plans of development, comparison of sites, selection of steam pressures and temperatures, determination of energy production costs and related problems. This is a permanent position with salary commensurate with experience. Liberal company benefits. Give full details including personal data, education and experience.

P-6284, POWER
330 W. 42nd St., New York 36, N. Y.

ELECTRICAL SUPERVISOR

to assist Chief Electrician; large institution requires the services of a graduate E. E. to assist in the operation and maintenance of the plant's electrical equipment and ultimately to assume full responsibility. Starting monthly salary will depend upon background.

P-6234, POWER
520 N. Michigan Ave., Chicago 11, Ill.

REPLIES (Box No.):
Address to office nearest you
NEW YORK: 330 W. 42 St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

(Additional Positions Vacant Ads on opposite page)

ASSISTANT CHIEF Engineer. Wisconsin paper manufacturer has an opening for an individual to assist our Chief Engineer in charge of paper mill power plant, supervising the operation and maintenance of high pressure boilers, turbines and auxiliary equipment. As this is a key position in our engineering staff, and because our engineers are expected to operate on a reasonably independent level it is essential that the man we are looking for have a sound and complete knowledge of the technical and practical aspects of power in order to be considered for this position. The salary is open. In addition we have what we believe to be an excellent profit-sharing retirement plan and, of course, the company pays for the complete cost of group hospital and surgical insurance as well as life insurance. Your reply will be held in strictest confidence. Write P-6361, Power.

CHIEF ENGINEER for steam electric plant in large transmission company, fully experienced in modern power plant operation using gas and oil for fuel. Permanent opportunity for thoroughly qualified man to take complete charge. Must be a master mechanic. P-6325, Power.

CHIEF ENGINEER to take charge of power plant of Midwestern paper mill. Must be experienced in boiler water treatment and operation of Stoker-fired boilers and mechanical-drive turbines. In reply state experience, age, education, and salary expected. Expense for interview, including travelling expense, will be borne by employer. All replies will be held in strict confidence. P-5907, Power.

ELECTRICAL ENGINEER: Wisconsin paper manufacturer has an opening for an electrical engineer with some experience in maintenance and layout. The man we are looking for will have a sound grasp of the technical aspects of electrical engineering as well as a year or more experience in an industrial situation. He should be familiar with plant electrical requirements, power and control equipment and wiring, both A.C. and D.C. Salary based on individual ability with excellent opportunity for financial advancement. In addition, we have a profit-sharing retirement program and the company assumes the cost of complete group insurance coverage. Your replies will be held in confidence. Write P-6362, Power.

PLANT MAINTENANCE Superintendent wanted for permanent position with heavy industrial plant in southwest. Applicants must have responsible experience in a similar capacity and be capable of assuming full responsibility for maintenance of all electrical and mechanical installations. Excellent opportunity for career employment. Salary open. Apply P-6170, Power.

SELLING OPPORTUNITIES OFFERED

MANUFACTURER'S AGENTS Wanted. A leading firm, nationally known in the marine field, manufacturers of a complete line of mechanical packings, is seeking competent sales representation in the industrial and sewage disposal field, either a firm or individual. Engineering knowledge and experience in this line will be given preference. You will be given specific territory, and also all inquiries and leads originating in the territory. Reply on your own stationery, giving engineering and sales experience in this field, territory now covered, number of employees, if any, and any other pertinent information. Replies will be treated in confidence. RW-5457, Power.

SALESMEN WITH following in industrial power plants and utilities wanted by manufacturer of boiler water, cooling water, and fuel oil conditioners. Quality products. High commissions. Excellent opportunity. Reply Chemical Testing Corporation, 20-28 41st Avenue, Long Island City 1, New York.

To

EMPLOYERS

who advertise

for MEN:

WHEN there are many applicants for a single position it frequently happens that the only letters acknowledged are those of the most promising candidates. Others may not receive any indication that their letters have even been received by a prospective employer much less given consideration. These men often become discouraged, will not respond to future advertisements, and sometimes question their bona fide character.

Every advertisement printed in the Searchlight Section is duly authorized.

It will help to keep our readers interested in this advertising if you will acknowledge every application received, even if you merely return the letters of unsuccessful applicants with, "Position filled, thank you" written or stamped on them. If you don't care to reveal your identity, mail them in plain envelopes.

We suggest this in a spirit of cooperation between employers and the men replying to Positions Vacant advertisements

★

"Put yourself in the other fellow's place."

★

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MECHANICAL ENGINEER

Large engineering and construction firm has permanent staff position open for mechanical engineer with experience in steam electric station operation to engage in plant betterment work which involves assistance in starting new units, testing, advising and consulting in respect to operating problems, improving steam plant efficiencies, advising in respect to procedures and maintenance practices, related problems. Reasonable knowledge of water treatment problems, practices, etc. desirable. Substantial traveling involved. Salary commensurate with experience; attractive company benefits. Give full particulars, age, education, experience in detail, and salary expected.

P-6286, POWER
330 W. 42nd St., New York 36, N. Y.

SALES ENGINEER

Fine opportunity for man with power plant acquaintance and experience in water treating field. Several territories open with old, well established company of highest technical standards. Drawing account and liberal commission. In complete confidence give age, experience, expected income, and full details. Our representatives have been notified.

SW-6153, POWER
330 W. 42nd St., New York 36, N. Y.

EMPLOYMENT SERVICE

SALARIED PERSONNEL. $3,000-$25,000. This confidential service established 1927 is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 241 Orange St., New Haven, Conn.

POSITIONS WANTED

BRITISH ENGINEER. Qualified specialist engineering stores sales promotion. Last position Sales & Technical Manager medium-size company. Age 26. Available 1st Jan. 1953. New York area. PW-6368, Power.

CHIEF ENGINEER, fully experienced in complete charge of operation and maintenance of modern steam turbo-generator and boiler plant. Industrial and Utility. PW-6243, Power.

DIESEL POWER Plant operator and Maintenance mechanic. Ten years experience marine and stationary operation and repair, including five years dual fuel. Will consider taking charge of small plant. 1st assistant unlimited horsepower marine license. 2nd class Minnesota steam 100 H.P. Age 44 years. PW-5209, Power.

MECHANICAL ENGINEER—Graduate; 7 years' experience with boiler manufacturer; 2 years operating large industrial steam plant; and 16 years in fuel business in combustion, sales, management. Looking for more responsibility with consulting engineers or large industrial. PW-6298, Power.

SUPT., ASST. Supt. of Chief Engr. position. Ten yrs. of steam, steam-elect. plant experience. Educated, but possess no degree, age 32, married, four children. Presently Supt. of medium size City power plant. Good reason for seeking change. Desire South or Mid-West. PW-6299, Power.

WANTED: POSITION as Chief Engineer or Power Plant supervisor. 20 years' experience in steam Power Plants, have a very good technical knowledge of engineering also have a first class engineers' license and best of references. PW-5914, Power.

SELLING OPPORTUNITIES WANTED

REPRESENTATION WANTED: Well established Manufacturers' Selling agency desires additional equipment applicable to petroleum refineries, chemical, industrial and power plants for Metropolitan New York district. RA-5417, Power.

TWO SALES Engineer want power or industrial process account for Phila. and 60 mile radius. SA-6319, Power.

OFFICIAL PROPOSAL

Notice is hereby given that sealed bids will be received at the office of The Board of Trustees of Public Affairs of the Village of Tipp City, Miami County, Ohio, until twelve o'clock noon on the 30th day of January, 1953, for the sale of the following described personal property:

One (1) single cylinder, 250 horsepower, horizontal Ames uniflow steam engine designed to operate on 150 psi saturated steam with 0-5 psi back pressure. Bore 19", stroke 20", 225 rpm. Engine is direct connected to a 210 kva, 2300 volt, 80% powerfactor, General Electric generator. Exciter is V belt driven from end of generator shaft. Unit is complete with all accessories including switchboard and voltage regulator and is in good condition.

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Both units are now in service and can be seen running if so desired. If sold, said units are in no way to be made inoperative until the successful completion of the expansion project now underway at our Municipal Light and Power Plant.

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Each bid shall be contained in a sealed envelope and plainly marked on the outside as "Bid on Machinery".

Bids may be for either or both units and the right is reserved to accept bids in whatever combination will effect the greatest sale price for the two units.

The right is reserved to reject any or all bids and to waive any irregularity in the form of bidding.

Said bids taken under authority of Ordinance No. 729, dated November 17, 1952.

By order of The Board of
Trustees of Public Affairs
Phyllis Giesseman, Village Clerk

GET 2nd ENGINEER PAPERS IN 1 YEAR

(Yes, get better stationary engineers License!)

No correspondence school bother. Nationally-known Chief Stationary Engineer Frederick C. Walker's 100-Question, 100-Answer Bulletins give you the straight dope quick. Send $3 to Walker & Collins, 526 Ashland Ave., Buffalo 22, N. Y. for first set today. Keep working. Save year.

Your inquiry will have special value . . .

if you mention this magazine, when writing advertisers. Naturally, the publisher will appreciate it . . . but, more important, it will identify you as one of the men the advertiser wants to reach with this message . . . and help to make possible enlarged future service to you as a reader.

CASH FOR SURPLUS

MOTORS
GENERATORS
TRANSFORMERS
COMPRESSORS

WORLD'S LARGEST INVENTORY

See our other ads on pages 278, 283

ELECTRIC EQUIPMENT CO.
ROCHESTER, N. Y.

BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES

No lengths too long or too short
TELEPHONE: EASTGATE 7-4778

PIERCE CABLE CO.
2668 CLYBOURN AVE., CHICAGO 14, ILLINOIS

WANTED

2—600 or 700 H.P. 2300/3/60 slip ring or synchronous with control speed 200 or 300 RPM 277 preferred.

Diesel engine generator sets 550/3/60 approximately 500 H.P. used or new.

SOUL CLINIC INC., Calgary, Alta, Canada

Idle or obsolete equipment purchased, dismantled & removed.

(We can dismantle anything made of metal)
Men—Tools—Insurance—35 years experience

G. M. LINDER
40-18 216 Street Bayside 61, N. Y.
Telephone BAyside 9-2121

FOR SALE

NO. 30 WELDED
PREMIER BOILER

By Combustion Engineering 150 pounds pressure with Skelly Stoker and No. 550 Prat-Daniel Stack, new July 1949, excellent condition, reasonable price.

CARPENTER & PATERSON, INC.
1190 Bennington St., East Boston 28, Mass.
Telephone No. East Boston 7-0718

FOR SALE

TERRY TURBINE 327 HP type GAZF 2 lbs. gage 26" vacuum 6060 RPM. 30#/BHP/HR. Original crate.

A. R. ANDERSON
768 Fifth Ave., NYC 19 PLaza 9-3000 Ext. 142

FOR SALE

Murray Auto-Extraction Turbo-Generator 150 KW, 80% PF, 220 V, 3 PH. Speed 4015, 1200. Pressure 200—PSIS, Ext. 10 PSI, Condensing Condensor, armatures & Switch Board.

J. FRED SCHMIDT PACKING CO.
253 E. Kossuth St., Columbus 6, Ohio

TWO B 18 STRONG SCOTT COAL MILLS

Serial Nos. 4648 left hand and 4649 right hand. Rated capacity 2000 lbs. per hour. One lot new spare parts for above.

LOUISVILLE CEMENT CORP.
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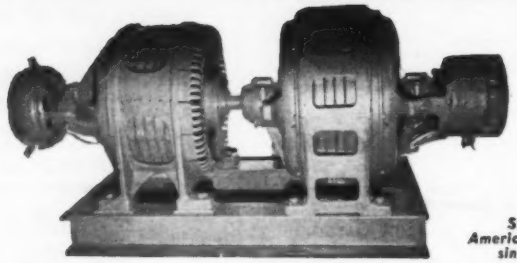

Serving American Industry since 1906

"Check with WAGNER FIRST"

PARTIAL LISTING OF LARGER ITEMS IN STOCK

A. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
750	Whse.	Synch.	2200/4000	900
700	G.E.	Synch.	2200	514
500	G.E.	Sq. Cage	6600/4000	1800
500	G.E.	Synch.	440	900
500	G.E.	Slipring	220/440	450
500	Al. Ch.	Synch.	440	400
450	Whse.	Synch.	2300	900
400	G.E.	Synch.	440	450
350	G.E.	Slipring	440	720
300	Al. Ch.	S. Cage	2200/440	720
300	El. Mach.	Synch.	2200/440	360
300	G.E.	Sq. Cage	2300	1800
300	Whse.	Synch.	2200/440	600
300	G.E.	Slipring	2300	1800
300	Al. Ch.	Slipring	2300	514
300	G.E.	Slipring	440	360
250	G.E.	Slipring	2300	450
250	G.E.	Slipring	440	600
250	Whse. (2)	Sq. Cage	2200/440	1200
250	L.A. (2)	Sq. Cage	2200	1800
225	E.M.	Synch.	440	1800
225	G.E.	Synch.	220/440	600
200	G.E.	Sq. Cage	220/440	600
200	Cr. Wh.	Sq. Cage	220/440	3600
200	Whse.	Sq. Cage	2200/440	900
200	G.E.	Slip Ring	220/440	600
200	E.M.	Synch.	220/440	1200
200	G.E.	Sq. Cage	220/440	1200
200	G.E. TEFC	Slipring	220/440	1200
200	Al. Ch.	Synch.	440	360
200	G.E.	Slipring	220/440	360
200	G.E.	Sq. Cage	220/440	1800
200	Rel. b.b.	Sq. Cage	220/440	1200
200	E.M.	Synch.	220/440	514
160	Whse.	Synch.	220/440	600
150	G.E. TEFC	Sq. Cage	2200	3600
150	Al. Ch.	Sq. Cage	2200	3600
150	G.E.	Slipring	220/440	600
150	Rel. b.b.	Sq. Cage	220/440	1200
150	Al. Ch.	Slipring	2200/440	720
150	G.E.	Sq. Cage	2200/440	720
150	G.E.	Slipring	220/440	450

A. C. GENERATORS — 60 CYCLE

KVA	Mfr.	Type	Volts	Speed
1000	Whse. syn. cond.		4000/2300	900
625	Gen. Elec.	ATB	2300	450
625	G.E. 25 cycle	ATB	2300	750
600	Gen. Elec.	ATB	480	900
500	El. Machy.		240/480	1200
485	Allis. Ch.	1 brg.	480	400
375	G.E.	ATI	240/480	1200
350	El. Machy.	1 phase	480	1200
312	Gen. Elec.	ATB	240/480	600
275	G.E. 25 cycle	ATI	480	750
250	Whse.	G	2400/480	600
225	Gen. Elec.	ATB	240/480	600
150	Whse.		2300/480	600
125	Gen. Elec. (2)	ATB	240/480	900
112	Gen. Elec.	ATB	240/480	900
75	El. Machy.		2300	900
56	G.E.	ATB	240/480	1200

M-G SETS

KW	Mfr.	Input V		Output V
500	Whse.*	2300	AC	250 DC
360	G.E.*	2300/4000	AC	250 DC
300	Whse.*	2300	AC	600 DC
250	Allis. Ch.	440	AC	350 DC
200	G.E.*	220/440	AC	250 DC
200	Gen. Elec.*	220/440	AC	125 DC
150	Whse.*	220/440	AC	125/250 DC
105	Century b.b.	220/440	AC	70 DC
100	Whse.*	2300/4000	AC	275 DC
100	Al. Ch.	220/440	AC	125 DC
100	Delco b.b.	220/440	AC	125/250 DC
100	Allis Ch.*	220/440	AC	50 DC
60	Gen. Elec.*	220/440	AC	60 DC
50	Gen. Elec.	220/440	AC	125 DC
50	Allis Ch. (2)	220/440	AC	125/250 DC
45	Gen. Elec.*	220/440	AC	60 DC
40	Whse.	220/440	AC	125 DC
40	Gen. Elec.	220/440	AC	250 DC
30	Otis (5)	220/440	AC	250 DC
25	Whse.	220/440	AC	125 DC
20	N.W.	220/440	AC	250 DC
20	Whse.	220/440	AC	600 DC
21	Whse.	220/440	AC	35 DC
17	Gen. Elec.	220/440	AC	125 DC

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Whse.	SK	600	900
250	Allis Ch. b.b.	EW	350	1200
150	Whse.	SK191	125/250	900
125	Gen. Elec.	RC38	250	675
105	Century b.b.	1500 amp.	70	1200
100	Whse.	SK	250	900
100	Allis Ch.	E	125	1200
60	Gen. Elec.	LC	250	700
50	Allis Ch.	E131	250	1200
50	Allis Ch. (2)	EW	125/250	1200
50	Gen. Elec.	RC	125	1200
40	Gen. Elec.	RC	600	1750
40	Gen. Elec.	RC	250	1150
25	G.E. b.b. New	CDM93	125	1500
20	Gen. Elec.	RC	125	1150
15	Star b.b. (10)	SQ	250	1500

D. C. MOTORS

HP	Mfr.	Type	Volts	Speed
300	Allis Ch. b.b.	EW	350	1000
200	Al. Ch. b.b.	E	250	600/1000
150	Reliance	1050T	230	1200
150	Gen. Elec.	RC39	230	550
100	Cr. Wh. b.b.	JH	115	1150
75	Whse.	SK	230	450/900
60/75	Gen. Elec.	C	230	500/1200
50	Gen. Elec.	CD123	230	550/1200
50	Al. Ch. (2)	E-131	230	1150
50	Gen. Elec.	RC33	115	1100
40	Gen. Elec.	RC32	230	1100
30	Gen. Elec.	LC	230	500/1500
30	Whse.	SK110L	230	1150
30	Star b.b.	SB	230	1750
25	Whse.	SK150	230	300/1200
25	G.E. b.b.	CDM93	115	1150
20	Whse. b.b. (2)	SK97	550	900

QUICK SHIPMENT FROM STOCK — LOW PRICES — FULL GUARANTEE

Gearhead Motors — Controls — Transformers

CERTIFIED

Arthur Wagner Co.

1435 W. RANDOLPH ST. MOnroe 6-7409 CHICAGO 7, ILLINOIS

LAND'S 44th YEAR

MOTORS & GENERATORS, etc.

1 YEAR GUARANTEE

GENERATORS—250 V. D.C. Motor Driven

KW	Make	Type	Speed
1000	Al. Ch.		720
250	Cr. Wh.	CCD	1200
200	West (2)	SK-18	1200
150	West.	SK	900
125	G. E. (2)	MPC	1200
125	El. Dy.	20L	1750
100	Delco (4)		1150
75	Cr. Wh.	51H	1150
50	Cr. Wh.	HH	1150
40	West.	SK	1750
35	G.E.	RC	1750
35	Al. Ch. (4)	3 wire	1750
25	G. E.	CS	1200
15	Star		1750
7½	West.	SK-43	1750
5	West.	SK-284	1750
5	Rel.	T-23T	1750
3	Rel.	T-14T	1740

GENERATORS—Low Voltage D.C.

Amp.	Make	Voltage
10,000	H-V-W	6
10,000	J-L	10
6000	El. Prod.	18/36
5000	H-V-W	6/12
4000	North.	7½
3000	Chandey.	12
2500	Chandey.	6/12
1500	H. V. W.	6/12
750	H-V-W-	6/12
1000	G. E.	15
1000	G. E.	25
1000	West.	24
100	Diehl	32
200	West.	35
200	Burke	35
125	Diehl	40
500	G. E.	32
1500	Century	45
3200	G. E.	50
325	West.	50
1000	G. E.	75

230 V. D.C. MOTORS

H.P.	Make	Type	Speed
250/200	Rel.	2600T	400/800
150	West.	SK	1150
150	West.	SK	850
125	Rel.	T	600
125/50	E. D.	20-SL	1750 1315
100	West. (4)	SK	1150
100	West. (6)	SK	850
100	Rel.	651-T	850
100	G. E.	RC	600
100	Rel.	1060T	500
100	A-C		1150
100	FM	TRC-38	725
110/55	G. E.	DMC	800/400
90/45	G. E. (2)	RF-17	950/475
75	G. E.	CD-155	1150
75	West. (6)	SK	1150
75	G. E.	RC	1000
75	Rel.	461-T	850
75	West. (2)	SK	850
75	West.	SK	475
75	Cr. Wh.	CMC-125H	375/950
60	West.	SK	850
60	West.	SK-160	680
60	West.	SK	250/1000
50	Cr. Wh.	CMC-FH	1750
50	G. E.	CD-93	3600
50	West.	SK-160	565
50	G. E.	RF-17	250/1000
40	G. E. (3)	CD-105	850
40	Cr. Wh.	FH	1750
40	West (5)	SK	775
35	E-D	258	350/1050
35	West.	SK	250/1050
35	West	SK	1150

SLIPRING MOTORS

H.P.	Make	Type	Speed
600	Cr. Wh.	131-AQ	507
500	G. E. (2)	IM	450
200	G. E.	MT-559Y	1175
150	G. E.	IM	870
125	West.	CW	1750
125	G. E.	IM	580
100	G. E.	MT347	1150
100	G. E.	IM	690

SQUIRREL CAGE MOTORS

H.P.	Make	Type	Speed
250	GE(TENV)	K-6335	1750
200	Wagner	RP2-26Z	1800
200	West.		1750
200	A. Ch	AR	865
200	G. E.	KF-6335	880
150	West.	CS	1175
150	G. E.	1K	580
125	A. Ch. (2)	53R	3500
125	A. Ch. (5)	AR	1890
125	Century		3500
125	A. Ch.		690
100	West.	C86078	3540
100	West.	CS	870

Partial Listing Only!

Please Send Us Your Inquiries

L. J. LAND, INC.

Established 1910

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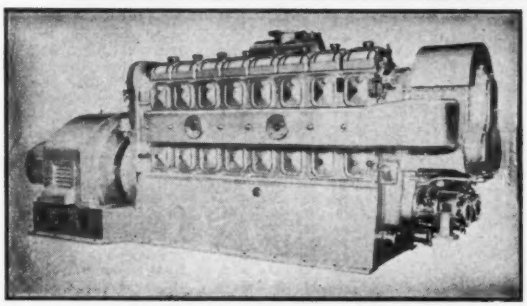
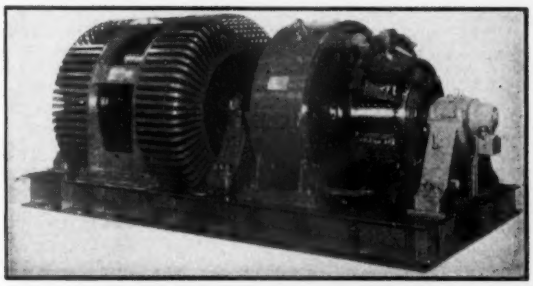
The O'Brien Machinery Company employs modern techniques, experienced craftsmen and the latest shop equipment to provide you with top quality, new, rebuilt and reconditioned machinery.



275 KVA GM DIESEL GENERATOR SET



500 KW WEST. MOTOR GENERATOR SET

MOTOR GENERATOR SETS

1—1000 KW West. 250 volt Flat Compound 500 RPM 1440 H.P. West. Syn. Mtr. .8 P.F. 3/25 cycle 2300 V. A.C. & D.C. Panels
1—500 KW Westinghouse 250 Volt 900 RPM with 720 H.P. West. Syn. Motors 3/60/6600/13200 volt, Serial #813047 (year 1935) See actual photo above.
1—500 KW Crocker Wheeler CCD, 250 volt 720 RPM with 750 KVA Cr. Wh. Syn. Motor 3/60/2300 V. A.C. & D.C. Panels.
1—300 KW West. 3 wire 125/250 Volt 1200 RPM Generator (1938 year). Can furnish with suitable motor. Advise Requirement.
2—150 KW G.E. Type MPC—250 Volt 1200 RPM 3/60/2300/200 H.P. Syn. Motor Drive A.C. & D.C. Panels.
1—100 KW Al. Ch., 250 V. 1200 RPM 150 H.P. Syn. Mtr. 2/60 or 3/60 any voltage.
1—100 KW G.E.—C.D.—125 Volt D.C. 150 HP GE Syn. Mtr., 3/60/220/440/1200 RPM.
1—75 KW Burke 250 V. 900 RPM 113 H.P. Burke—Syn. M.D. 2 or 3 ph, any voltage.
2—50 KW GE 500 Volt DC, 75 HP, 3/60/440/1200 RPM.
Smaller Sizes and Types—Advise Requirements

OISC TRANSFORMERS

Qu.	KVA	Make	Pri. V.	Sec. V.	Phase
3	4000	GE	33000	13200	1
3	1000	GE	13200	2300	1
1	1000	Penna.	13200	480	1
1	1100	West.	4440	440	3
3	833	GE	13800	460	1
3	750	West.	2300	230	1
3	500	GE	13200	2300	1
3	333	(New)	2400	480	1
3	333	GE	13200	2300	1
3	250	West.	13200	2300	1
3	200	GE	7200	120/240	1
3	200	GE	13200	2300	1
3	200	Mal.	2300	220/440	1
3	200	GE	13200	2300	1
3	200	GE	7200	2300	1
3	150	GE	33000	220/440	1
3	150	Niag.	2400	240/480	1
3	100	West.	11000	480	1
3	100	GE	7200	120/240	1
2	100	GE	2300	115/230	1
3	75	Mal.	2300	115/230	1

OISC TRANSFORMERS (Con't)

3	50	GE	13200	120/240	1
3	50	GE	13200	2300	1
4	37½	West.	2400	240/480	1
3	25	West.	2300	115/230	1
3	25	West.	6900	2300	1
2	15	GE	2400	120/240	1
3	10	GE	220	110	1
10	1½	GE	2400	120/240	1

DIESEL & GASOLINE GENERATOR SETS

6—875 KVA G.E.—Busch Sultzer 3/60/2300/275 RPM, Complete Plant, 1940
5—475 KVA Cooper Bessemer 400 RPM 3/60/2300, Complete Plant, New 1940
1—375 K.V.A. GM 8-268A, 3/60/480/1200 RPM
1—187 KVA G.M. Twin 6-71 Portable, 3/60/220/440 New
1—125 K.V.A. Hercules. 3/60/220/440/1500 Hrs
1—56 K.V.A. Climax Gasoline, 3/60/220/1200.
2—45 K.V.A. Chry. New 6 Cyl. 3/60/220/440.

ELECTRIC MOTORS

Qu.	HP	Make	Type	Volts	Speed
1	1000	West.	CW	2300	450
1	600	West.	CS	2200	600
1	500	AC	ARX	2300	1800
1	500	West.	CS	6600/2300	514
1	450	A.C.	ANY	2300	600
2	400	G.E.	IK	2300	1800
1	400	West.	CW	440	514
1	400	G.E.	Syn.	2300	450
1	350	West.	TEFC	440	1800
1	350	G.E.	MT18	2300	400
1	315	G.E.	Syn.	2200	720
1	200	G.E.	IM	440	600
1	125	West.	Syn. 3 brg.	550	600
2	100	G.E.	Syn.	440	300
1	50	West.	CS	440	3600
1	50	West.	CS	440	1200

COMPRESSORS

968 CFM Sullivan 13x13x8, 50 psi.
868 CFM Sullivan 17x10x12, 100 psi.
528 CFM Ing. Rand 14x12, 100 psi.
368 CFM Chi. NSB, 12x10, 100 psi.
173 CFM Pa. 3A—9x8, 100 psi.
122 CFM Worth. 7x7, 100 psi.
89 CFM I.R.—ES 16x7, 150 psi.

TURBO GENERATORS

1—1250 KVA DeLaval Non-Cond. 3/60/2300. New 1940 240 psi 50 lb. B.P.
1—750 KVA G.E.-Moore 3/60/2300/3600 RPM Non-Cond. 180 PSI 35 lb. B.P. New 1936.
1—500 KVA West. Non-Cond. 3/60/220/440, 150 PSI 10 lb. B.P.
1—375 KVA West. Non-Cond. 3/60/440, 125 PSI 5 B.P. New 1938.
1—200 KVA Moore Non-Condensing 3/60/458, 195 PSI, 100° F, 100# BP. Year 1936.
1—187 KVA West. Non-Cond. New 1930 3/60/440 110 psi 10 lb. B.P.
1—94 KVA Worthington Non-Cond. 3/60/220 140 psi 5 lb. B.P.
1—75 KW G.E. Non-Cond. D.C. 125 volt.

MOTOR GENERATORS

1500 KW G.E. 250 Volt 3/60/2300/360 RPM
100 KW Electro Dynamic 200 V. 3/60/220/1200 B. Brg. Sq. Cg. Syn. Excited.
200 KW Elliott 250 Volt 1200 RPM 3/60/Any Voltage.

DIESEL GENERATORS

200 KW G.M. Twin 6-71, 240 D.C. Rad. Cooled Elec. Start.
1250 KVA Nordberg 3/60/2300/360 RPM new 1940.
250 KVA G.M. Twin 6-71, 3/60/220/440/1200 RPM Rad. Cooled.

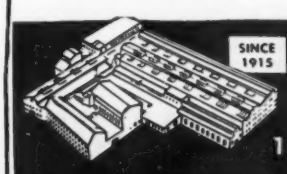
AIR COMPRESSORS

1—12,000 CFM I.R. Turbo 3.25 lb., direct 250 H.P., 440/3/60/3600.
1—5600 CFM I.R. PRE-2, 42/25½x30, 100 lb. direct 930 HP Syn. 1 P.F. 2300/60/3.
1—4690 CFM I.R. PRE-2 48/24x27 100 lb. direct 804 HP Syn. .8 PF 2300/60/3.
1—3000 CFM GE Turbo 5 lb. direct 90 HP 440/3/60/3600.
2—1400 CFM Sullivan WJ 8 Angle Cpd. 100 psi 22/13x16 belt.
1—900 CFM CP 100 lb. 9CP Portable Diesel Compressor, Pneu. tires.

BOILERS

1—60 H.P. Ames Package 125 psi, 1947.
2—200 H.P. Bigelow Scotch, 150 Lb. Oil Fired, 1940.
1—300 H.P. Keeler CP, 160 Lb. Stoker 1940.
1—350 H.P. Keeler CP, 160 Lb. Oil Fired.

"Everything from a Pulley to a Powerhouse"



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BREW-WOLTMAN OFFERS

TURBINE UNITS

1—5000 KVA West. 3/60/420 V. 3600 RPM EXTRACTION nozzled for 385 psig 550° TT. 2 extraction openings 80,000# at 125 psig and 16,000# at 20 psig. 7500 sq. ft. surface condenser.
1—3750 KVA West. 3/60/2300/4000 V. 3600 RPM STRAIGHT CONDENSING nozzled for 375 psig 575° TT 11.75# water rate, 5500 sq. ft. surface condenser.
1—1250 KVA Al. Ch. 3/60/480 V. 3600 RPM, Terry 11 stage EXTRACTION turbine nozzled for 250 psig 550° TT, 40,000# extraction at 25 psig, 995 sq. ft. surface condenser.
1— 625 KVA El. Mchy. 3/60/480 V. 1200 RPM with direct connected exciter, gear driven, Worth. multi stage NON-CONDENSING turbine 4650 RPM now nozzled for 125 psig and 10 psig BP, suitable for pressures up to 300 psig. New 1949. Various other turbines.

BOILERS

1—90,000# Springfield sectional header cross drum 400# WP 750° TT new stoker fired.
1—50,000# Edgemoor bent tube 255# WP 490° TT Coxe chain grate stoker and economizer. New 1929.
2—502 HP nominal Heine water leg type 200# WP 480° TT Coxe chain grate stokers. New 1929.

DIESEL ENGINE UNITS

1—2800 HP Nordberg 6900 V. 60 cy.
1—2000 HP Fairbanks Morse 6900 V. 60 cy.
1—1600 HP Fair. Morse 2300/4150 V. 60 cy.
1— 600 HP Enterprise Dual Fuel 2400 V. 60 cy.
1— 250 HP Buckeye 240 V. 60 cy.

STEAM ENGINE UNITS—60 CY.

1—675 KVA Skinner Vertical Uniflow 480 V.
2—312 KVA Ames Vertical Uniflow 240 V.
1—250 KVA Ames Vertical Uniflow 480 V.
1—200 KVA Skinner Uniflow 230 V.
2—187 KVA Ames Vertical Uniflow 240/480 V.

MOTOR GENERATOR SETS—60 CY.

QU.	KW	MFR.	VOLTS-DC	A.C.	RPM
1	3000	G.E.	250	13200	514
1	2000	G.E.	600	4000	450
1	1500	G.E.	600	4150	600
2	1000	West.	660	4150	900
1	200	West.	275	2200	900
2	200	G.E.	250	4150	1200
2	150	G.E.	250	2300	1200
1	75	Ridgway	125	220	1200

SYNCHRONOUS MOTORS—60 CY.

QU.	HP	MFR.	VOLTAGE	RPM
1	3000	G.E.	6600	360
2	2500	A.C.	13200	514
2	700	West.	2300	200
1	600	G.E.	2300	240
1	500	G.E.	2300	600
1	300	West.	2300	900

FREQUENCY CHANGERS

QU.	KVA	MFR.	CYCLES	RPM
1	12500	G.E.	25/60	300
1	3750	G.E.	25/60	300
1	3125	G.E.	25/60	300
1	2500	G.E.	25/62½	750
1	1875	A.C.	60/25	300
1	1700	West.	60/24	720

OIL CIRCUIT BREAKERS—Outdoor

1— 600 A. 73 KV G.E. FHKO-236-500
1— 400 A. 37 KV G.E. FHKO-136-350
1— 400 A. 37 KV G.E. FHKO-236-500
4— 600 A. 15 KV G.E. FHKO-139-750
1— 600 A. 15 KV G.E. FHKO-136-250
1—1200 A. 15 KV G.E. FKO-139-350
1— 400 A. 7.5 KV G.E. FKO-227-50

1—6000 A. 600 V. G.E. AL-2-100 AIR

TRANSFORMERS

4— 3333 KVA West. 69200/66000—33000
4— 500 KVA West. 69000—6900
3— 300 KVA G.E. 66000/33000—2300, 3 ph.
3— 75 KVA A.C. 66000/24000—7200/12470 Y
3— 200 KVA A.C. 45000—2100/7200
3— 150 KVA G.E. 44000—7200/12470 Y
3— 75 KVA West. 44000—7200/12470 Y
4— 5000 KVA G.E. 40935/70900 Y—14500
1—18750 KVA A.B.B. 34840—11000, 3 ph.
2— 5000 KVA West. 33000—26400, 3 ph.
3— 300 KVA G.E. 33000/66000—2300, 3 ph.
4— 200 KVA A.C. 34500—6900/11950 Y
3— 150 KVA Wag. 33000—7200/12470 Y
3— 100 KVA A.C. 33000—7200/12470 Y
3— 100 KVA West. 33000—240/480 NEW
3— 75 KVA Wag. 33000—7200/12470 Y
6— 2125 KVA G.E. 26100/13200—2300
4— 1500 KVA A.C. 25400/44000—6900/13800
4— 450 KVA A.C. 25410/44000—13280/23000
3— 1250 KVA G.E. 23000—2300/4000
3— 100 KVA G.E. 22000—7200/12470 Y
1— 4000 KVA Mol. 13800—460, 3 ph.
1— 450 KVA Penn. 13200—2400, 3 ph.
3— 200 KVA G.E. 13800—2300
1— 3750 KVA G.E. 11000—2300, 3 ph.
2— 200 KVA G.E. 11500—220/110
3— 250 KVA Pitts. 7200—220/410
3— 150 KVA Wag. 6900—2300
4— 100 KVA G.E. 6800/11900—2400
3— 37½ KVA G.E. 6600—230/460
3— 1500 KVA A.C. 2300/4000 Y—2300
1— 100 KVA G.E. 2300—575, 3 ph.
6— 50 KVA West. 2400—114/228 DRY TYPE
3— 15 KVA Stand. 450/225—117 DRY TYPE

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DIESEL ENGINES

500 HP GMC Winton 204-8 (marine) 1000 RPM 4 cycle GMC 6-71 Twin Diesels (Excellent condition)

AC MOTORS

6000 HP at 93-1/3 cycle 400 RPM or 3800 HP at 60 cycle 257 RPM GE
50 HP at 220 V 870 RPM 2 ph. West. (slip ring)

DC MOTORS

1500 HP 525 V 600 RPM Westinghouse
1350 HP 388 V 1300 RPM General Electric
675 HP 350 V 1300 RPM General Electric

TRANSFORMERS

50 KVA to 6000 KVA

DC DIESEL GENERATOR SETS

60 KW Superior model	GA-8
80 KW Cummings	HGD
60 KW BUDA	6DCG
60 KW Cummings	HGD

AC DIESEL GENERATOR SETS

210 KVA Chicago Pneumatic	4-H-40-S
75 KW Cooper-Bessemer	GAWD
40 KW Buda-Lanova	6LD

AC TURBO-GENRATOR SETS

200 KW 450 V 1200 RPM 3 ph. 60 cycle Gen. Elec.

DC TURBO-GENERATOR

300 KW 240 V 1200 RPM General Electric

DC GENERATORS

1200 KW 525 V 750 RPM Allis Chalmers
1070 KW 525 V 750 RPM General Electric
258 KW 260 V 900 RPM General Electric

NEW CONDENSERS

400 sq. ft. Allis Chalmers—155 sq. ft. Conseco

REDUCTION GEARS

1000 HP 7400 RPM to 300 RPM Falk Marine Reversing Reduction Gear with Airflex clutch
Twin disc assembly, duplex, manufactured by Link Belt Engr., Co., 950 HP a 2400 RPM input shafts, output speed 596, 4 RPM
NEW Westinghouse Main Reduction Gear Marine Gears type SA-131, HP 1766—RPM P 670G 350 rating 1.937:1

NEW STEAM TURBINES

General Electric, 1000 HP, 525# temp. 825°FF., with Falk Reduction Gear, pinion RPM 5405, gear RPM 3060, complete with throttle valves and other parts
56.5 HP 300-475 lbs Steam—10—151 lbs. Exh. Pressure. 1225-1600 RPM Sturtevant

GASOLINE ENGINES

Sterling "Admiral" (marine) 800 HP 2200 RPM
Hall Scott "Defender" (marine) 680 HP 2100 RPM with reduction gear
Wright Hispano Suiza, 360 HP 1750 RPM

MOTOR GENERATOR SETS, DC 230 V to 3/60/120

25 KVA Continental
25 KVA Burke Electric Comoany

ROOTS-CONNERSVILLE BLOWERS

16"x18" 14"x21" 20"x45" 24½"x49"

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35000-CFM-1" S.P. 230 V. D.C. Wing

WELDING MACHINES DIESEL DRIVEN

1000 Amp. Dualarc with Buda Model 468 Diesel Eng.

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made by Dempsey Industrial Furnace Corp.

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from 105 CFM to 500 CFM, Ingersoll Rand, Schramm, Gardner-Denver, Chicago-Pneumatic

CENTRIFUGAL PUMPS

from 1000 GPM to 6000 GPM, 100/300 feet, also motor driven pumps

HICYCLE TOOLS—3/180/220

(Motor generator set available)

drills, nut runners, screwdrivers, impact wrenches

CONCRETE BRICKMAKING MACHINES

Brickmaster Model 10

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Caterpillar Model D50 diesel power tractor crawler mounted, with LaPlante-Choate straight blade bulldozer

HOIST & WINCHES

15000 lb. pull at 78 FPM, 3360 lb. pull at 348 FPM and 2 Auxiliary Drums driven by Chrysler 28.35 gasoline engines (NEW) LST stowing winch with 15 HP motor

Air Coolers — Air Ejectors
Push button starters, 7½ HP
Pumps, motor & turbine driven
Heat exchangers — Diesel parts
Oxygen producing plant — Welding electrodes
Vertical plate Bending roll, capacity 1⅛"x14"
Niles heavy duty plate shear—16" knife, 36" gap
Niles Bement plate planer, 20", 2" cutting heads
Milling machines — Fork Platform Lift trucks
Degreasing Machines — Viscilizer pump
Feed rails, 1000 amps, 3 conductor
Wire rope — Centrifuges — Machine Tools
Light Bulbs, 1000 Watt, 220-250 V. (clear)
LST Equipment, Capstans, Pumps ect.

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SQUIRREL CAGE

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volt (*2200 Volts or Higher)

H.P.	Make	Type	Speed
1750	*G.E.	K	3600
1000	*G.E.	K63478	1800
750	*A.C.	TEFC	1800
750	*G.E.	KT	720
700	G.E.	FT	3600
500	*G.E.	PBG	3600
500	*A.C.	63168W	1800
450	*G.E.	KF5678	1200
400	*Westgh.	CS	1800
400	*G.E.	KPT562	1800
400	A.C.	ANW	900
400	*G.E.	IK	514
350	*Cr.-Wh. BBDP	8C	3600
300	*Westgh.	CS	3600
250	*L. Allis	OG8	1800
250	*L. Allis	OGX148S	720
250	G.E.	IK	600
200	*G.E.	FT549Y	3600
200	A.C.	ARWWT	600
200	G.E.	IK-17	600
150	*A.C.	AN	1800
150	*G.E.	IK	600
150	A.C.	AR	325
125	Westgh.	CS5043	3600
125	*A.C.	AR226	1800
125	G.E.	IK	1200
100	*G.E.	FT542Z	1800
100	Westgh	CS	1800
100	G.E.	IK13A	1200
100	U.S.	CFU (Vert)	1200
100	A.C.	AN	900
100	G.E.	IK15A	514
75	Westgh.	CS4458	3600
75	A.C.	AN	1800
75	Westgh.	CS645C	1800
75	G.E.	IK	1200
75	Westgh.	CS	900
75	A.C.	AN	720
75	G.E.	IK	600
75	*Triumph	TR16	514
60	*Westgh.	CS5048	1800
60	G.E.	KT343	1200
60	A.C.	AR823	900

Hundreds of Smaller Motors!

AC SYNCHRONOUS

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or Higher)

H.P.	Make	Type	P.F.	Speed
2500	*A.C.		1.0	514
1420	*Westgh.		.7	900
720	*G.E. (25 cy)	ATI	1.0	750
700	*G.E.	TS975Z	1.0	1200
600	*G.E	TS7640	1.0	900
400	Westgh.	22E38	1.0	900
300	G.E.	ATI	.8	900
300	Ideal	SNS	1.0	257
190	El.-Machy.	28	1.0	720
150	*Westgh.	HR	1.0	300
125	*El. Machy.	XXX	1.0	900
125	*G.E.	TS	1.0	277
115	El. Machy.	EM	1.0	240
100	Cr.-Wh.	103S	.8	900
100	Westgh.		1.0	900
100	G.E.	TS6184	1.0	450
40	G.E.	ATB	.8	1200
20	Fynn-W.	15VRN		1200
15	Ideal			1800
15	Century	ARC365	1.0	1200
7½	Ideal			1800

AC SYNCHRONOUS

GENERATORS

3 Phase, 60 Cycle, 220 or 440 Volt (*2200 Volts or Higher)

KVA	Make	Type	P.F.	Speed
3500	*G.E		9	720
1750	*Westgh		.7	900
1500	G.E	ATI	.8	720
312	G.E.	ATI	.8	900
300	*G.E	ATI	.8	720
112½	*G.E.	ATB	.8	1200
110	Cr.-Wh	103	.8	900
100	*G.E.	ATB	.8	900
60	Fairbanks-M	B	.8	900
55	G.E.	ATB	.8	1200
50	G.E.	ATB	.8	1200
50	Westg.			1200

SLIP RING

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or Higher)

H.P.	Make	Type	Speed
2500	*G.E.	MT	257
1500	*G.E	MT30	240
1000	*Westgh.	CW	250
700	*A.C.		720
500	*G.E.	IM	3600
500	*G.E.	MTP	1800
500	G.E	IM	720
500	Westgh	CW	350
400	A.C.	3-Brg	450
400	*G.E.	MT412	450
300	*G.E.	IM15A	1800
300	*G.E.	MT410	450
250	Westgh.	HF15H	600
200	G.E.	IM	1800
200	Westgh.	CW	600
150	Westgh.	CW772C	1200
150	*G.E.	IM16	600
125	*G.E.	MT549	1800
125	G.E.	IM15A	600
100	A.C.	ANY	900
100	G.E.	IM15A	450
75	Northwestern	HW50	1800
75	G.E.	MT356	900
75	G.E.	IM14	600
60	Westgh.	CW762C	900
50	G.E	IM11A	1800
50	*A.C.	ARY	1800
50	Westgh.	CW642C	1200
50	G.E.	MT346	720
50	G.E.	IM14	450
40	G.E.	MT336	1200
40	Westgh.	CW644	900
40	G.E.	M504U	900
35	Fairbanks-M	UAB (Vert)	1800
35	G.E.	IM	1200
30	G.E.	MT532	900

M. G. SETS

K.W.	Make	A.C.	D.C.
2400	A.C. (3-unit)	4800	525
2400	West. (3-unit)	4800	600
1000	G.E. (3-unit)	11000	137½/275
1000	West. (3-unit)	11000	137½/275
500	A.C.-Westgh.	2300	250
500	Cr.-Wh.	220/440	250
450	G.E. (3-unit)	2300	125/250
400	A.C.	2300	120/240
250	Westgh.-G.E.	440	250
200	Ridgeway	2200	250
150	G.E.	2300/440	250
150	G.E.	2300/4000	125/250
150	G.E.	440	275
100	G.E. (25 cy)	440	125
100	G.E.	2300	250
100	Delco-GE	440	120/240
90	G.E.	440	60
75	A.C.	440	250
60	A.C.	2300	110
60	G.E.	440	250
40	Cr.-Wh.	220	125
40	A.C.	220	125
40	G.E	220	125
35	G.E.	440	125
25	Westgh.	2200	125
25	G.E.	220	275
20	G.E.	440	250
20	Bogue-G.E.	440/550	250
20	Bogue-G.E.	220/440	250
20	Bogue-G.E.	220/440	125

DC To AC

100	G.E.	230	235
75	Westgh.	2300	110
12½	Westgh.	240	115

ENG. GENERATOR SETS

KVA	Make	Type	Volts	Speed
300	Gen. Motors	8-268A	480	1200
100	Gen. Motors	6-71RC	480	1200
100	Gen. Motors	3-268A	480	1200
31	Cummins-Rogers	H-I-6	120/208	1200
25	LeRoi	20-A	120	900

MODERN PLANT, LATE-TYPE MACHINES AND EXPERT WORKMEN ARE AN OUTSTANDING COMBINATION

CHICAGO ELECTRIC's plant is modern in every sense of the word . . . it is fully equipped with the latest type machines and testing equipment . . . it is staffed with competent and experienced workmen. This combination of machines and men has provided users of electrical power equipment with a guaranteed and outstanding service for over 42 years.

D. C. MOTORS

Mill Type—Pedestal Bearing Reversing

H.P.	Make	Volts	Speed
3000	Westgh. (Tandem)	525	600
1750	Westgh.	600	550
1500	Westgh.	525	600
1200	Westgh.	525	600
1000	Westgh.	450	600

Mill Type—Non Reversing

H.P.	Make	Type	Speed
1500	Westgh. (600 v)		200/400
700	Westgh. (600 v)	MCF	150/525

230 Volts—Constant Speed

H.P.	Make	Type	Speed
175	G.E.	ELC	750
125	G.E.	Marine	1200
100	G.E.	RC34	2500
100	G.E.	RC19	575
75	G.E.	MDS106	485
60	G.E.	CD-115	860
50	G.E.	RC35	730
50	G.E.	CO2004	600
40	Cr.-Wh.	CMC	1750
35	Cr.-Wh.	CM351	700
30	G.E.	MD104½	725
30	Cr.-Wh.	CCM	440
25	G.E.	CD93	1200
25	G.E.	RC32	800
25	Westgh.	SK100L	1100
25	Westgh.	SK133	575

MANY OTHERS — 1 HP AND UP ALSO VARIABLE-SPEED AND 115 VOLTS

COMPLETE STOCKS ON HAND

CHICAGO ELECTRIC's modern plant also houses one of the nation's largest stocks of guaranteed rebuilt power equipment . . . AC & DC MOTORS, M. G. SETS, GENERATORS, CONVERTERS, COMPRESSORS, HOISTS, PUMPS, TRANSFORMERS, CONTROLS and other allied equipment . . . so, whatever you need and whenever you need it . . . be sure to check with CHICAGO ELECTRIC first!

TRANSFORMERS

KVA	Make	Ph.	Pri.	Secondary
1000	Westgh.	3	4800	480
850	Westgh.	3	4160	455
667	G.E.	1	33000	480
333	A.C.	1	14400	240/480
300	G.E.	3	15800	240/480
300	G.E.	3	2400	240/480
200	Wagner	1	2400	575
167	A.C.	1	2400	120/240
100	Pitts.	1	2400	575
100	A.C.	1	2400	120/240

HI-PRESSURE

PUMPS

GPM	Make	Type	Head
800	Worth	6D8	925 ft.
500	Manistee	H	250 ft.
300	Al.-Ch.	NMZ	800 ft.

IF YOU DON'T FIND WHAT YOU WANT LISTED WIRE, WRITE OR PHONE TODAY!

PHONE: CANAL 6-2900

CHICAGO Electric Co.

1328 West Cermak Road, Chicago 8, Ill.

MOTORS—M. G. SETS—TRANSFORMERS

ENGINEERED AND REBUILT BY EXPERTS IN OUR OWN PLANT

SYNCHRONOUS MOTORS

Qu.	H.P.	Make	P.F.	Volts	R.P.M.
1	6000	G.E.	100	2300	90
1	3000	Whse.	80	4800/2400	720
2	2100	G.E.	100	2300	360
2	1750	G.E.	100	2300	360
1	750	G.E.	80	2300	450
1	600	G.E.	100	440	360
1	700	G.E.	80	2300	720
1	250	G.E.	100	2300	514
1	200	Whse.	80	440	1200
1	187	G.E.	80	440	720
1	150	G.E.	100	2200	900
1	150	G.E.	100	550	600
1	120	G.E.	80	550	450
2	135	G.E.	80	4000/2200	1200
3	125	El. Mchy.	100	4800/2400	900
1	125	G.E.	80	2200	900
2	100	Whse.	80	440	1800
1	100	Ideal	80	440	900
2	100	G.E.	80	440	600

With these we can supply—Manual, Semi on full magnetic reduced or full voltage control.

SQUIRREL CAGE MOTORS

3-Phase — 60 Cycle

Qu.	H.P.	Make	Type	Volts	R.P.M.
1	400	Cont.	NZ-806	2300	1200
1	400	G.E.	I-K	2200	v514
1	400	G. E.	KT-412	2200	450
1	300	Whse.	CS-890	2300	1780
1	200	Whse.	CS-873-C	2200	1200
1	200	Al.Ch.	ARY	440	600
2	125	Al.Ch.	AR	2200	1750
1	125	Al.Ch.	AR	2300	514
1	125	C.W.	126-Q	440	430
2	100	Whse.	CS-663-C	440	1750
1	100	Al.Ch.	AR	550	720
1	100	Whse.	CS-938	2200	514
1	100	F.M.	H-241	440	450
2	75	Al.Ch.	AR	2200	1705
1	75	G.E.	I-K	440	600
1	75	Al.Ch.	AR	2200	720

Special—1 (new) G.E. Vertical KF-574, 2200-Volt 580 R.P.M., enclosed, hollow shaft.

MOTOR GENERATOR SETS

Qu.	KW	Make	RPM	Volts DC	Volts AC
½(3-U)	2400	Whse.	720	600	2400/4800
2	1500	G.E.	600	600	4150/2300
3	1000	Whse.	514	600	11000/6600
4	1000	G.E.	514	600	11000/6600
1	1000	G.E.	514	600	2300
2	500	C.W.	720	575	2300/440
1	400	C.W.	1200	125/250	440/2300
2	250	Whse.	1200	125/250	2300
1	200	Ridgway	900	275	2300
2	200	Whse.	1200	125/250	440
1	155	G.E.	720	250	2300/440
2	150	Whse.	1200	250	2300
1	100	Al. Ch.	1200	125/250	4000/2300
1	100	Delco	1200	125/250	440/220
1	100	Ridgway	1200	275	4000/2300
1	100	C.W.	1200	125	440/220
1	85	C.W.	1200	250	440/220
1	75	Al. Ch.	900	250	2300
1	75	Whse.	900	75	2300
1	25	Ideal	1750	125	220
1	25	Al. Ch.	1200	250	440/220
1	20	Al. Ch.	1200	250	440/220
3	15	Al. Ch.	1200	250	440/220

We can furnish any of these sets with exciters and VARIABLE VOLTAGE CONTROL engineered and rebuilt to your requirements.

TRANSFORMERS

Qu.	KVA	Make	Type	Phase	Voltage
1	2750	G.E.	H	3	13,800-2400/4160Y

This now being completely rewound with (2) 2½% taps above and below on 13,800 side.

3	250	Packard	A	1	13,200-2200
3	150	Packard	A	1	2300-230/460
3	100	G.E.	H	1	33,000-2300
3	25	G.E.	H	1	2400-120/240
40(new)	3	Al.Ch.	OISC	1	2400-120/240

Motor Generators of modern design, complete with control — still on their original foundations — available for immediate shipment.

SLIP RING MOTORS—CONSTANT DUTY

3-Phase — 60 cycle

Qu.	H.P.	Make	Type	Volts	R.P.M.
1	1800	G.E.	MT 498	2300	357
1	1200	G.E.	MT 26	2200	277
2	1000	Al.Ch.	ANY	2200	235
1	800	G.E.	MT	2200	440
1	700	Whse.	CW	2300	720
1	600	G.E	MT 20	2300	360
1	500	Al.Ch.	ANY	2200	514
2	500	G.E.	I-16-M	2300	450
1	400	G.E.	MT 412	2200	440
1	250	Whse.	CW 937	440	1200
1	250	Al.Ch.	ANY	440	720
1	250	G.E.	MT 414	2200	300
1	125	Whse.	CW 870	2200	900
1	100	Whse.	CW 766	440	1200
1	100	F.M.	H 20 C	440	900
2	100	G.E.	I-15A-M	2300	514

DIRECT CURRENT MOTORS

Qu.	H.P.	Make	Type	R.P.M.
1***	3000	Whse.	Encl. (Rev.)	600
1***	2400	Whse.	Encl. (Rev.)	600
4***	1500	Whse.	Encl. (Rev.)	600
4***	1200	Whse.	Encl. (Rev.)	600
4***	800	Whse.	Encl. (Rev.)	600
1	350	G.E.	CD-169-A	1150
1	200/250	El. Dy.	No. 22	400/1200
1	250	G.E.	MPC	325/975
1***	200	G.E.	MPC	500/1500
1	200	Whse.	Mill	300/1200
1	180	G.E	MPC	460
1***	125	Whse.	SK-190	600
2	125	Whse.	SK-184	575/850
1	90/160	G.E.	MPC	625/1125
1	100	Rel.	1050T	400/1200

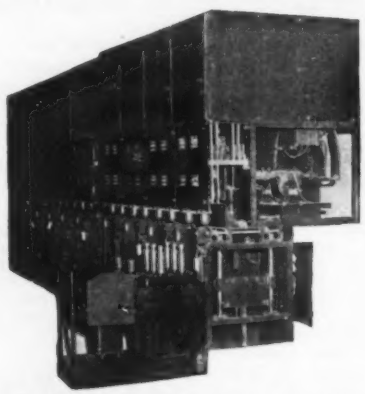
All above 230-VDC except where marked***

***—Pedestal bearing mill design 525/600-VDC.

Rev.—designed for mill reversing service.

T. B. MAC CABE COMPANY

4314 CLARISSA STREET — Phone DAvenport 4-8300 — PHILADELPHIA 40, PENNA.



GENERAL ELECTRIC DRAWOUT OIL CIRCUIT BREAKERS

13—General Electric type MI-9 drawout type Metal Clad Switchgear, each unit containing one FK-143R, 1200 ampere, 7500 volt, 3 pole, 50,000 KVA oil blast oil circuit breaker, solenoid operated, 125 volt DC, complete with control switch, indicating lamps, current and potential transformers.

The above is one complete switchboard but can be divided to suit your needs.

OUTDOOR OIL CIRCUIT BREAKERS (without oil)

Qu.	Make	Type	Volt	Amp.	Control	Int. Cap.
2	G. E.	FHKO-236-2452-BF73	73,000	600	Motor	500,000
1	G. E.	FHKO-136-2046	73,000	400	Solenoid	350,000
2	G. E.	FKO-136-2046-BS	50,000	400	Solenoid	280,000
1	Condit	FO-40-37-C	37,000	400	Solenoid	750,000
1	G. E.	FHKO-236-1640-BS	37,000	400	Solenoid	500,000
1	G. E.	FHKO-136-2046	37,000	400	Solenoid	500,000
1	G. E.	FKO-136-1026-AS	25,000	400	Manual	125,000
3	Condit	OI	23,000	400	Manual	60,000
1	G. E.	FKO-139-24-AS	15,000	600	Solenoid	350,000
1	G. E.	FHKO-136-1328-BS	15,000	600	Solenoid	250,000
1	G. E.	FKO-139-24-AS	15,000	1200	Solenoid	350,000

POLE LINE SWITCHES

Qu.	Make	Type		Volt	Amp.	Control	Int. Cap.
17	Condit	PK-5	3 pole	4,500	200	Non-Auto.	10,000
10	El. Spec.		3 pole	7,500	200	Non-Auto.	10,000
4	G. E.	FKO-37	3 pole	15,000	400	Solenoid	40,000
1	G. E.	FKO-37	3 pole	37,000	400	Solenoid	40,000

OUTDOOR CURRENT TRANSFORMERS

Qu.	Make	Type	Volt	Ratio
2	G. E.	K-202	25,000	15/30/5
3	Westg.	OA	34,000	15/30/5
2	Westg.	OB	45,000	15/30/5
2	Westg.	OB	47,000	40/80/5
6	Westg.	D-22	23,000	50/100/5
3	G. E.	K-61	37,000	150/300/5
3	Westg.	OA	34,500	200/400/5
3	A-C	CW	34,500	800/5/5

NEW AND RECONDITIONED SWITCHGEAR

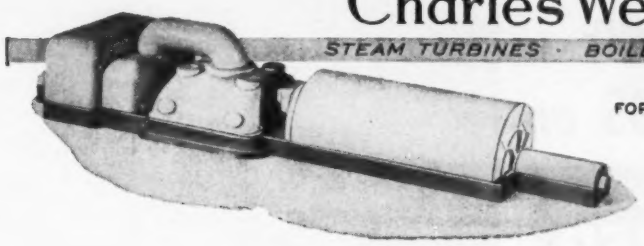
JOSEPH P. MANYPENNY CO.

PHONE DE 6-3300

1667 MEADOW ST. — **PHILADELPHIA 24, PA.**

Charles Weaver

STEAM TURBINES · BOILERS AND DIESEL ENGINES



FORTY-FIRST FLOOR, PENOBSCOT BUILDING
DETROIT 26, MICHIGAN
WOODWARD 1-1340, 1-1341, 1-6038
CABLE ADDRESS "CHASWEAVER"

OUR SPECIALTIES ARE

Dependable Turbo-Generators, Boilers, Diesel Engines

Any-Everything for the Power Plant

A Partial List of Our Stock is Given Below

TURBINE GENERATORS

CONDENSING: ALL 3600-RPM.

No.				
1	500-KW.	A.-C.	150/200 psig.	480-V
2	500-KW.	G.-E.	150/200 psig.	480-V
3	625-KW.	G.-E.	160/200 psig.	480-V
4	750-KW.	A.-C.	150/200 psig.	480-V
5	750-KW.	West.	140/200 psig.	2300-V
6	750-KW.	Elliott	150/200 psig.	480-V
7	750-KW.	A.-C.	150/200 psig.	2300-V
8	750-KW.	G.-E.	150/200 psig.	480-V
9	1000-KW.	G.-E.	175/250 psig.	2300-V
10	1000-KW.	A.-C.	125/200 psig.	2300-V
11	1000-KW.	2G.-E.	400# psig.	2300-V
12	1500-KW.	A.-C.	150/200 psig.	2300-V
13	2000-KW.	G.-E.	175/200 psig.	2300-V
14	2000-KW.	G.-E.	150/200 psig.	2300-V
15	2500-KW.	G.-E.	150/250 psig.	2300-V
16	3000-KW.	G.-E.	150/250 psig.	480-V
17	5000-KW.	G.-E.	150/200 psig.	2300-V

NON-CONDENSING: 3600-RPM.

No.				
1	500-KW.	A.-C.	125#:10/15 BP.	480-V
2	500-KW.	G.-E.	175#:10/15 BP.	480-V
3	500-KW.	West.	250/400:125# BP.	2300-V
4	750-KW.	G.-E.	125#:10# BP.	480-V
5	1000-KW.	G.-E.	125#:15 BP.	480-V
6	1250-KW.	G.-E.	200/250 psig, 20# BP.	480-V
7	2000-KW.	West.	250/350#:35# BP.	2300-V
8	2500-KW.	G.-E.	150/175#:15# BP.	2300-V
9	3000-KW.	West.	425#750F:60# BP.	13200-V
10	4000-KW.	G.-E.	425#, 75° FSH. 60# BP.	13200-V

WESTINGHOUSE 500-KW. TURBO-GEN.

Non-condensing

Above Unit is in first class condition. Steam, Initial 250/400-psig., 150# Back Pressure.

BOILERS: Available: Immediate Delivery

1—Springfield, Same as NEW, 615-HP., 42,500# Steam per Hr., operated 60 days only. Working pressure 275#. Riley Stoker. Complete with all Trim.
2—B&W, 1000-HP, 225 working pressure. Excellent condition.
2—B&W, 604-HP., Good for 25%—Continuous overload rating or 750-HP.
Above are both Sectional Headers.

All for Immediate Delivery

ALSO: Motor Generator Sets: Pumps, Diesel Engines, Fans, Etc.

ALL FOR IMMEDIATE DELIVERY — **ANYTHING FOR THE POWER PLANT**

OUR COMPLETE STOCK LIST BULLETIN IS AVAILABLE. SEND FOR IT TODAY.

CORRESPONDENCE INVITED

PHONE, WRITE OR TELEGRAPH

CHARLES WEAVER

4145 Penobscot Building
Detroit 26, Michigan

TEL. WO. 1-1340
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There's more than 40% to 60% SAVINGS on

SCHOONMAKER DEPENDABLE DIESEL POWER

because:

Each Schoonmaker-sold Diesel Engine Unit is fully REMANUFACTURED in our plants by highly skilled, factory-trained Diesel engineers. Only genuine factory-made and approved parts are used and all REMANUFACTURING is in strict accordance with manufacturer's recommended procedures. Prior to shipment every engine is subjected to a FULL LOAD operating test in accordance with DEMA standards.

The Schoonmaker Plants and Warehouses located in Jersey City, N. J. and Sausalito (San Francisco), California give NATIONWIDE SERVICE from Coast to Coast with modern, efficient and reliable facilities.

Our reputation and many years of experience and SPECIALIZATION in Diesel power equipment gives you value that money cannot buy elsewhere.

So—Buy SCHOONMAKER because you buy the FINEST in DEPENDABLE DIESEL POWER.

America's largest source of New and Remanufactured Diesel Power

See our Ad on the opposite page

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SCHOONMAKER CO., INC.

50 CHURCH ST., NEW YORK 7, N. Y.

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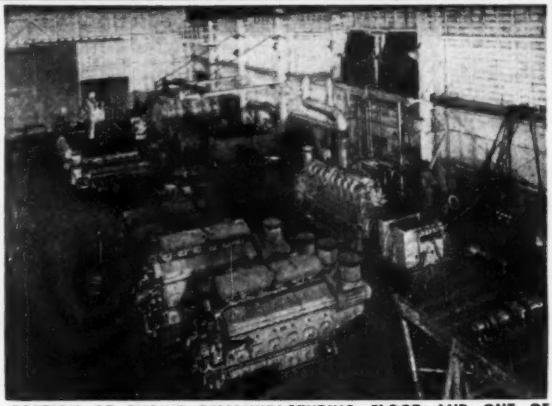


PORTION OF ENGINE REMANUFACTURING FLOOR AND ONE OF THE ENGINE TEST STANDS AT OUR SAUSALITO, CALIF. PLANT.

A PARTIAL LIST OF OUR INVENTORY

KW	MAKE	MODEL	HP	RPM
1500	Fairbanks Morse	33E16	2000	300
1136	Fairbanks Morse	38D	1600	720
1100	General Motors	16-278A	1600	720
1000	General Motors	16-567B	1440	720
750	General Motors	12-567	1080	720
500	General Motors	8-278A	750	720
500	Baldwin	VO-8	750	514
500	General Motors	8-567	720	720
400	Ingersoll-Rand	S-8	600	720
350	Baldwin	VO-6	510	450
320	Buckeye	80	480	600
320	Enterprise	DSG-6	460	450
250	Fairbanks Morse	33-D	375	360
300	General Motors	8-268A	450	1200
200	General Motors	8-268A	350	900
167	Ingersoll-Rand	S	255	600
160	Buckeye	80	240	600
150	Worthington	CC-4	225	450
100	General Motors	3-268A	150	1200
100	Worthington	BB-5	150	600
60	General Motors	6-71	90	1200
30	Inter. Harvester	UD-14	45	1200

ALTERNATING AND DIRECT CURRENT UNITS
STANDARD AND SPECIAL VOLTAGES AS REQUIRED

ONE YEAR GUARANTEE!

MOTOR GENERATOR SETS

WORLD'S LARGEST INVENTORY

Item A	1750 KW, 600 volt—250 KW, 250 volt—2800 HP, 25 cyc, syn drive
Item B	3—1500 KW, 125/250 volt 500 RP MGE MG sets, 2100 HP, 11,000 volt, 25 cycle drive.
Item C	1000 KW, Allis Chalmers 250 volt, rotary convertor, any voltage
Item D	2—1000 KW, 250 volt MG sets, 25/60 cycle drive.
Item E	2—1000 KW, 600 volt, MG sets, 60 cyc. synchronous drive

We invite your inquiries LD-65, Station Collect, Motors, Generators, Transformers

ELECTRIC EQUIPMENT COMPANY

ROCHESTER, N. Y.

A.C. MOTORS (3 Ph. 60 Cy.)

HP	MAKE	VOLTS	TYPE	SPD.	WDG.
400	Al. Ch.	2200		514	S.R.
400	G.E.	2200	MT	450	S.R.
300	G.E.	2200/4000	IM	450	S.R.
200	West.	220	CW	600	S.R.
150	G.E.	220/440	ATI	600	Syn.
125	West.	220		277	Syn.
100	G.E.	440	IM	450	S.R.

D.C. MOTORS (250 V.)

HP	MAKE	WDG.	TYPE	SPD.
400	G.E.	Cpd.	MPC	1000
300	Cr. Wh.	Cpd.	CCD	1000
200	Triumph	Cpd.		450
150	G.E.	Cpd.	DLC	800
75	G.E.	Cpd.	RC	600
60	West.	Cpd.	SK	435
20/25	West.	Series	K5	975/875
6¾/7½	West.	Series	K3	680/585

M-G SETS

400 KW	West.	720 RPM 600 V. Syn. 3/60/2300 v.
300 KW	G.E.	1200 RPM 250 V. Syn. 2300/4000 v.
240 KW	G.E.	1200 RPM 250 V. Syn. 2300/4000 v.
225 KW	G.E.	1200 RPM 125 V. Syn. 2300/4000 v.
150 KW	G.E.	1200 RPM 250 V. Syn. 2300/4000 v.
100 KW	Rldg.	1200 RPM 250 V. Syn. 2300/4000 v.
75 KW	West.	1200 RPM 250 V. Syn. 220/440 v.
50 KW	G.E.	1200 RPM 250 V. Sq. Cg. 220/440v.
35 KW	G.E.	1800 RPM 125 V. Sq. Cg. 220/440v.

MOORHEAD ELECT. MACH'Y. CO.

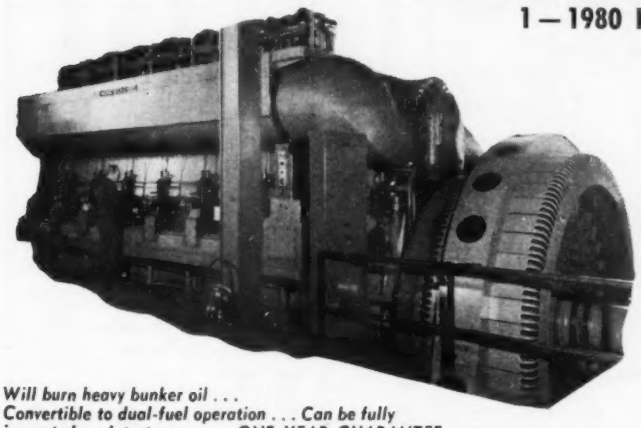
P.O. Box 7991P Pittsburgh 16, Pa.

CURRENT MODEL·· DIESELS

3480 KW DIESEL GENERATOR PLANT

Heavy Duty • Slow Speed • Available Immediately

1—1980 KW NORDBERG MODEL TS-217 DIESEL UNIT



Will burn heavy bunker oil . . .
Convertible to dual-fuel operation . . . Can be fully inspected and test run . . . ONE YEAR GUARANTEE

ENGINE: 3000 HP (2800 BHP net) Nordberg, 7 cylinder, 2 cycle Diesel engine at 225 RPM, 21¾" bore, 29" stroke, cylinders arranged vertical in line, solid injection.

GENERATOR: 1980 KW, 2475 KVA General Electric generator, 2400/4160/6900 volts, 3 phase, 60 cycle service at 225 RPM.

(50 cycle rating 1650 KW at 187 RPM)

UNIT AUXILIARIES AND ACCESSORIES

Complete standard engine auxiliaries and accessories including filters, strainers, pumps, gauge board, pyrometer, thermocouples, exhaust muffler, lubricating oil cooler, Young evaporative type cooler for jacket water cooling, thermostatic control valve, fuel oil day tank with transfer pump and oil meter, 2 lubricating oil storage tanks, lubricating oil transfer pump, Diesel-driven air starting unit, air tanks, air intake filter, special engine tools, all station piping, including flanges, adapters, valves, and fittings, for air intake, exhaust, water, lubricating oil, fuel oil, and air.

Generator and exciter control switchgear.

1—1500 KW FAIRBANKS MORSE MODEL 33E16 DIESEL UNIT

ENGINE: 2000 BHP Fairbanks Morse 10 cylinder, 2 cycle engine at 300 RPM, 16" bore, 20" stroke, cylinders arranged vertical in line, solid injection.

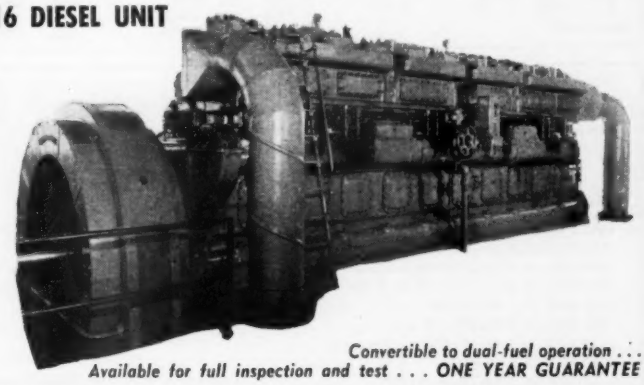
GENERATOR: 1500 KW, 1875 KVA Fairbanks Morse generator, 2400/4160/6900 volts, 3 phase, 60 cycle service at 300 RPM.

(50 cycle rating 1250 KW at 250 RPM)

UNIT AUXILIARIES AND ACCESSORIES

Complete standard engine auxiliaries and accessories including filters, strainers, pumps, gauge board, pyrometer, thermocouples, exhaust mufflers, lubricating oil cooler, Fairbanks Morse evaporative type cooler with automatic controls, fuel oil day tank with transfer pump and fuel oil meter, motor-driven air starting unit with air tanks, 2 lubricating oil storage tanks with transfer pump, air intake filter, special engine tools, all station piping, including flanges, adapters, valves, and fittings, for air intake, exhaust, water, lubricating oil, fuel oil, and air.

Generator and exciter control switchgear.



Convertible to dual-fuel operation . . .
Available for full inspection and test . . . ONE YEAR GUARANTEE

The two units above afford a rare opportunity to procure complete, modern, current model, heavy-duty, slow speed diesel sets at a great saving. They represent an offering which cannot be duplicated anywhere in the diesel market today.

Act now . . . Phone, Wire, or Write for Full Details

ALL OWNED AND OFFERED EXCLUSIVELY BY

TELEPHONE
DIGBY 9-4350

TELETYPE
NY 1-2804

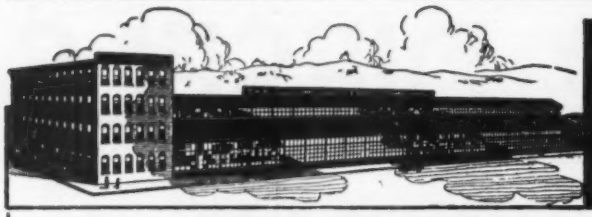
"America's Largest Source of New and Remanufactured Diesel Power"

A.G. SCHOONMAKER CO., INC.

Western Union — WUX —
A. G. Schoonmaker Co. Inc., N. Y.
CABLE:—AGSCOMACH

50 CHURCH ST., NEW YORK 7, N. Y.

Plants and Warehouses: **Jersey City, N. J. and Sausalito (S.F.), California**



GLOW ELECTRIC CO.

927 HARRIET ST. CINCINNATI 3, OHIO
PHONE MAIN 3024

MEMBERS OF AMERICAN REBUILDERS ASSOCIATION, A MEMBER BODY OF AMERICAN STANDARDS ASSOCIATION

SQUIRREL CAGE, OPEN 3 PHASE MOTORS

HP	RPM	VOLTS	DESCRIPTION
750	900	6600	Westinghouse
350	3600	2200	Westinghouse
300	1200	2300/440	Westgh., CS
300	900	440	G.E.
200	490	2200	G.E.,-I
125	3600	220/440	A-C
125	1800	2200	A-C
115	1200	440	G.E.
100	1800	2200	Westinghouse
100*	1200	2200	G.E.-KF544
100	1200	2300/440	A-C, AR.
100	720	440	Westgh. 3 Brg.
85	3600	2300	G.E.
60	3600	2200	G.E.
60	1800	2200	G.E.
50	3600	220/440	G.E.-404B
50	1800	220	Triumph
50	720	2200	Westinghouse
40	1800	220/440	West.-444
40	900	440	G.E.
40	720	440	G.E.
35	3600	220	G.E.-KT
35	600	440	G.E.
30	3600	220/440	Westgh., 364
30	1800	440	GE-KT323
30	720	220	G.E.
30	514	440	Stanley
25	3600	220/440	L-A
25	1800	220/440	A-C, Fr. 365
25	1200	220	A-C, AN
25	900	440	G.E.
25	600	440	G.E.
20	3600	440	A-C
20	1800	220/440	G.E.
20	1800	220/440	G.E.
20*	1800	220/440	Wesehe.
20	1200	220	Westgh., CS
20	900	440	A-C
20	600	220	G.E.
15	3600	220	G.E.
15	1800	220/440	G.E.
15	1200	220	Imperial
15	900	220	Howell

*New Motors

4 SPEED MOTORS AND CONTROL

Century, Model SCNM504Y90IAV, 20 HP, 440 volt, 3 Phase, 60 Cycle, 1700/1120/870/560 RPM, Multi-speed, ball bearing. With plugging switch mounted on shaft; motors on adjustable hinge bases. Control —Allen Bradley, Magnetic.

SLIP RING MOTORS

HP	RPM	VOLTS	DESCRIPTION
400	514	440	West.-CW
375	1800	2300	Al. Ch.
350*	514	440	G.E., TE, FC, BB
300	514	440	Al. Ch. 3 Brg.
250	600	2200	G.E.-117B
250	450	2200	C.-W.
250	450	2200	G.E.-1-17B
250	300	2200	Al. Ch.
200	1800	440	Al. Ch.
200	600	440	West.-CW
200	600	440	G.E.-1M
200	514	440	West.-CW
150	1800	2200	FM-HV
150	720	2200	Al. Ch.
150	600	220	Wagner
125	1750	2200	West., CW
120	900	550	Ideal
100	720	440	Al. Ch.
100	600	2200	G.E. MT-562
100	600	220	Wagner
100	400	440	West. Elec. (GE)

*New

MOTOR GENERATOR SETS

D.C. OUTPUT KW	Voltage	Description	A.C. INPUT HP	RPM	Volts
1500	600	G.E., MCF	2100	720	13200
1200	525	Al. Ch.-G.E.	2000	720	2300
800	500	West., 3 unit	1200	1200	2300
800	250	Westgh.	1200	1200	2300
750	550	G.E.	1070	900	2300
750	500	Westgh.	1070	900	13200
750	250	Westgh.	1070	900	13200
600	250	Westgh. (2-300KW Gen.)	1200	1200	2300
600	250	G.E.	900	900	2300
400	250	Westgh.-G.E.	600	1200	220/440
300	250	G.E.	450	1200	2300
200	125	G.E.,-Westgh.	300	720	2300
200	125	G.E. (25 cy.)	300	730	440
200	250	G.E.-Westgh.	300	1200	440
100	250	Delco-Westgh.	150	1200	220
100	250	G.E.	150	1200	220/440
75	125	G.E.	115	1200	440
50	125	C-W	85	1800	440
47½	125	Al. Ch.	100	1200	2300
40	250	Westgh.-G.E.	60	1200	220/440
35	125	G.E.	50	1800	2200
22	125	Al. Ch.	33½	900	220
20	115	G.E.-Al. Ch.	30	900	220
15	250	Al. Ch.-L.A.	25	1800	220/440

PLATING AND ANODIZING SETS

D.C. OUTPUT AMPS	VOLTS	RPM	DESCR.	HP	A.C. END VOLTS	DESCR.
4000	2 to 8	425	Jantz & Leist			
2400	40/80	1200	Westgh.	290	440	WH Sync.
1500/750	8/12	1200	Munning Loeb	15	440	GE—1 Cage
1200	60	1150	Century	108	220/440	Century, SCN-584
1000	60	1200	Century	100	440	Century Cage
1000	6	1200	Wagner	—	—	—
800	30	900	C-W	40	220	C-W type 122Q
680	11	900	Westgh.	15	440	W.H. BB.
600	50	900	E-M	40	440	A-C
600	30	1200	W-E	30	440	GE
600	30	900	G.E.	25	440	GE
500	40	1200	G.E.	30	440	GE-KT
500	12	1200	Ideal	10	220	GE-KT
500	6		GE Rectifier	—	440	—
415	12	1200	HVW	7½	440	GE-KT
400	40	1800	Hobart	25	220/440	Hobart
208	62	1800	G.E.	20	220/440	GE-KT

MOTOR GENERATOR SETS

Two 75 KW GE 250/125 v—3/60—220/440 v

NON-CONDENSING TURBO UNITS

1563 KVA GE 3/60-2300 v
937 KVA GE 3/60-480/240 v
625 KVA Al. Chal. 3/60-480 v—Elliott
300 KVA Al. Chal. 3/60-480 v—Elliott
250 KVA GE 3/60-480/240 v
125 KVA GE 3/60-480/240 v
125 KVA GE 3/60-480/240 v—300# bp
62 KVA GE 3/60-240 v
20 KVA GE 3/60-240 v—Terry

BLEEDER TURBO UNIT

1563 KVA GE 3/60-2300 v—250#—12# bp

MODERN DIESEL UNITS 480/240 V.

375 KVA Elec. Mchy-Buckeye 8 cl.
312 KVA (2) Wghse-Worthington 6 cl.
250 KVA Elliott-Buckeye 5 cl.
220 KVA (2) Wghse-Buckeye 7 cl.
187 KVA Ideal-Buckeye 6 cl.
125 KVA (2) General Motors (New)
75 KVA (2) General Motors
50 KVA GE-Caterpillar
50 KVA (2) GE V belt—60 HP F.M. 42F
37 KVA General Motors

BOILERS

4500 LB (3) B&W-F19 integral Furnace, 275#
309 HP Comb. Engr. 160#
300 HP Keeler, CP 300#
255 HP (2) Comb. Engr. 200#
125 HP Erie City (packaged VL) 200#

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt St.
New York, N. Y.

BOILER FEED PUMPS

2—A.-Ch. 400 G.P.M., type ML, 6 stage, size 5 x 4, 1614 Ft. Hd.
1—Worth. 740 G.P.M., type WCS-2, 5", 2250 Ft. Hd.
1—Worth. 700 G.P.M., type UNS-1, 6 stage, 6". 1550 Ft. Hd.
2—I. R. 200 G.P.M., 2", 1375 Ft. Hd.
Pumps above are mounted on basis for motor or turbine drive.

We have about 200 various size cent. pumps on hand, turbine, motor, and gasoline driven. Send us your inq.

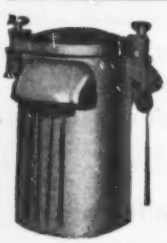
DALTON SUPPLY CO.
2829 Cedar St. Phila., 34, Pa.

ELECTRICAL CABLE

- For every Industrial and power application.
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular suppliers.
- Cut to length. Reasonably priced.

UNIVERSAL WIRE AND CABLE CO.
2668 N. Clybourn Ave., Chicago 14, Ill.

—TRANSFORMERS—



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We carry a large stock of transformers, and invite your inquiries. New Transformers built to your specifications.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes. One Year Guarantee.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912 CINCINNATI 27, OHIO

REFRIGERATION UNITS

TWO PRACTICALLY NEW WORTHINGTON CARBONDALE

REFRIGERATION COMPRESSORS

300 Ton Freon

Ideal for large plant or office building

WILL SACRIFICE

WINSTON MACHINERY CO., INC.
326 WEST OHIO STREET
INDIANAPOLIS, INDIANA

RE-NU-BILT BELYEA MOTORS

THE TRADE MARK WITH A MEANING SUCCESSFUL OPERATION GUARANTEED 44th YEAR OF SERVICE—MEMBER OF A.R.A.*

MOTOR GENERATOR SET

3 ph. 60 Cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	2000	G. E.	514	600	13800/4000
2	2000*	G. E.	500	600	6600/11000
3	1500	G. E.	514	250	4000/13200
1	1500	G. E.	720	600	6600/13200
1	1500	G E.	360	275	2300/4400
3	1500	G. E.	600	600	2300/4150
1	1500	C.W	514	115	2300
1	1200	A.C.	720	550	2300
2	1000	Whse.	900	600	2300/4100
1	1000	G. E.	900	260	6600
1	1000(3U)	G.E.	900	250	2400/4800
2	750	Whse.	900	275	2300/4160
1	750	C.W.	514	115	2300
1	600	G. E.	720	250	440/2300
1	500	Whse.	900	125/250	440
1	500	Whse.	900	250	6600/13200
1	500	Whse.	1200	125/250	2300
1	500	G. E.	720	125	2300/4000
1	400	G. E.	720	250	440/2300
1	400	Whse.	1200	250	2300
1	350	G. E.	900	125	2300/4150
1	150	G. E.	1200	250	2300
1	150	Whse.	1200	275	2300
1	150	G. E.	1175	125	440
1	140(3U)	Cr.-Wh.-	690	125/250	2300
1	125	G. E.	1200	125	440
1	100	Delco	1200	125/250	440
1	75	G. E.	1200	125	4000
1	50	Whse.	1775	575	208

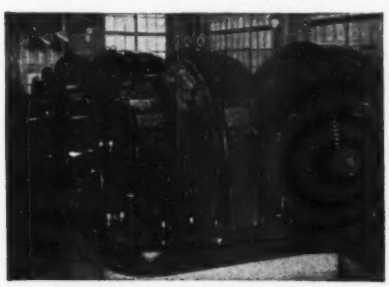
*25 Cycle

ROTARY CONVERTERS

1—2000	G. E.	514	600		13800
1—1000	Whse.	900	600		11000

TURBO GENERATORS

Qu	KW	Make	Desc.
1	1000	Moore	Auto-Ext. Cond. 175/200# I.S.P. 5/20# G. Ext. Surface Condenser—3/60/2300.
	1000	G. E.	Non-condensing 175/200 lbs. I.S.P. 5/20 lbs. G.B.P., 480/3/60.
1	750	G. E.	Condensing 425#-725*TT I.S.P. 440 V. 3 ph. 60 cy New — 1944
1	750	Whse.	Non-condensing 135# I.S.P. 40# B.P. 750 Kw. 280 V. D.C.
1	500	Moore	Non-condensing — 150/200 lbs. ISP 5/35 lbs. G.B.P.—3/60/480 volts direct connected exciter.
2	500	G. E.	Non-condensing 175/200 lbs. I.S.P., 5/30 G.B.P., 480/3/60.
1	400	Whse.	Non-condensing 125/150# I.S.P. 5/10# G.B.P., 240/480v. 3 ph. 60 cy.
1	300	G. E.	Non-condensing 10/175# I.S.P. 5/15# B.P. 480V. 3 ph. 60 cy.
1	200	Whse.	Non-condensing 150# I.S.P. 7# B.P. 240 V. 3 ph. 60 cy.



3—1500 KW—250 V. D.C.—13200 V. A.C. NOW AVAILABLE.

D.C. MOTORS

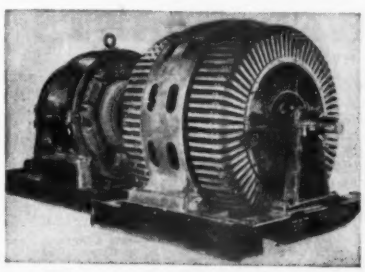
Qu.	H.P.	Make	Type	Volts	Speed
1—	2200	G. E.	MCF	600	360/500
1—	1750	West		600	525/720
1—	1500	Whse.		525	600
1—	910	Whse.	QM R Brg.	250	140/170
1—	900	Whse.		250	450/550
1—	600	Al. Ch.	MILL	230	400/800
1—	500	Whse.	Mill	600	300/900
2—	450	Whse.		550	415
1—	400	G. E.	MCF	550	300/1050
1—	300/400	G. E.	DYNA	250	1325/2500
1—	350	Cr. Wh.	CCM-151H	230	1100
1—	335	Whse.	MQ	250	300/900
1—	200/300	G. E.	MPC	230	360/920
1—	250	G. E.	MPC	230	400/500
1—	200	Rel.	1970T	230	720
1—	150	G. E.		600	250/750
10—	150	Cr. Wh.	83H	230	890
1—	150	Cr. Wh.	CMC-65H	230	1150
1—	150	Whse.	SK-201	230	360/950
1—	150	Whse.	SK-151 B	230	900/1800
1—	50/120	G.E.	MFC	230	250/1000
2—	100	Whse.	SK-181	230	450/1000
1—	60	El. Dy.	25-S	230	525/1050
2—	50/60	Whse.	SK-170	230	400/1200

FREQUENCY CHANGERS

Qu.	KW	Make	Cycles	Voltage
1—3000		G. E.	25/60	4000/2300x2300/4000
1—2000		G. E.	25/62½	2300/4160
1—2000		Whse.	25/62½	2300/2300
1—1000		G. E.	25/58	4400/2300
1— 500		A. C.	25/60	11000/2300V

SYNCHRONOUS CONDENSERS

Qu.	Kva	Make	Volts	Speed
1	5000	Whse.	2400/4800	600

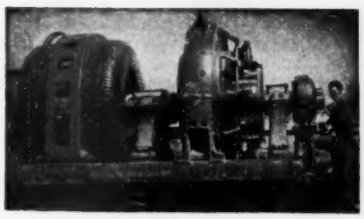


500 KW MG SET IN STOCK

TRANSFORMERS

60 Cycles

Qu.	KVA	Make	Type	Ph	Voltages
3	2000	G. E.	HVDDJ	1	66000x13800
3	1000	G. E.	H	1	2200x480
3	1250	G. E.	H	1	6600x550
1	1150	A. C.	OISC	3	13200x2300/480
1	500	Whse.	OISC	3	13400x216
9	300	G. E.	HT	3	2400x240/480
3	150	Whse.	OISC	1	33000x2300/4000
3	100	G. E.	OISC	1	2400x120/240
2	75	Upte	OISC	3	4160x240
1	50	Mol.	Ankerel	3	13200x120/208
3	10	G. E.	H	1	2300x115/230
9	7½	G. E.	H	1	2300x115/230



2000 KW—MG SET IN STOCK

A. C. MOTORS

3 ph. 60 Cycle

SYNCHRONOUS

Qu.	HP	Make	Type	Volts	Speed
1—	5000	Whse.		2500/5000	600
1—	4350	Cr. Wh.		4160/13800	514
2—	3500	G. E.	TS	2300	257
1—	2500	Whse.		2300	720
2—	2100	G. E.	ATI	2300	360
1—	2000	Whse.		2300	120
2—	1750	G. E.	ATI	2300	3600
3—	735	G. E	ATI	2200/12000	600
1—	500	Ideal	SM	2300/4150	1800
1—	450	Whse.	Eng.	2200	128.5
1—	450	Whse.		2300	450
2—	350	G. E.	TS	2200	150
1—	300	Whse.		2300	720
1—	150	Whse.		440	600
1—	100	Whse.		550	600
1—	100	F.M.		220	1200

SLIP RING

1—1800	G. E.	MT-498	2300	360
1—1500	ABB		2300	720
1—1200	G. E.	MF-26	2300	275
1— 500	Whse.	CW	500	360
2— 500	G. E. unused	M-574Y	2200	900
1— 500	G. E.	IM	440	900
1— 450	Whse.	CW	4000	700
1— 400	Whse.	CW	440	514
1— 350	G. E.	MT-442Y	2300/4000	253
2— 300	G. E	MT-565Y	2300	900
1— 300	A. C.		410	514
1— 250	G. E.	MT-424Y	4000	250
1— 250	G. E.	MT-559S	2200	1750
1— 250	A. C.		550	600
1— 200	Cr. Wh.	26QB	440	505
1— 200	G. E.	IM	410	435
1— 200	G. E.	MTP	410	1170
1— 200	Whse.	CW	410	490
1— 200	G. E.	IM	440	600
1— 150 new	Whse.	CW	2300	450
2— 125	A.C.		440	865
1— 125	A. C.		440	720
4— 125	G. E.	MT-566Y	440/2200	435
1— 100	G. E.	IM-16	2200	435
1— 100	G. E.	IM	440	600
3— 100	Al. Ch.	ANY	440	695
1— 100	G. E.	MT556	2200	900

SQUIRREL CAGE

2— 650	G. E.	FT559BY	440	3750
2— 450	Whse.	CS	2300/4150	354
1— 200	G. E.	IK-17	400	580
3— 200	G. E.	KT557	410	1800
1— 200	G. E.	KT-559Y	2300	1200
1— 200	G. E.	IK	440	865
1—75/150	G. E.	IK	440	450/900
1— 150	Whse	CS	440	580
1— 150	Wstghse.	C8856S	410	830
1— 125	Whse	MS	440	485
1— 125	G E	KF-TEFC	440	3585
2— 125	A.. Ch.	ARW	2200	1750
1— 100	G. E.	IK-Vert.	2300	150
1— 100	G. E.	KT-543	220/440	1750
2— 100	G. E.	IK	440	580

*American Rebuilders Association — Member Body of A.S.A.

BELYEA COMPANY, INC.

OFFICE AND SHOP

43 HOWELL ST., JERSEY CITY 6, N. J.

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MOTORS • GENERATORS • TRANSFORMERS

7 x 7 AIR COMPRESSOR

Ingersoll Rand 7x7 Class ERI—100#—with or without drive.

1—400 KW Westinghouse 500 V. DC 750 RPM 800 Amps. Motor—580 H.P. Synchronous 3 Ph. 25 cycle 440 V. 750 RPM.

ANODIZING M.G. SET

33 KW Gen. Elect. Type BR. Form C 60 V DC. Direct connected to 50 HP 3/60/440 1800 Gen. Elect. Motor.

400 HP GEAR REDUCER

1—400 HP Nuttall (Westinghouse) Type LMR-25 Single Helical Heavy Duty Reducer—6-1 Ratio at 900 RPM with High Speed Shaft Extension for Brake.

400 HP SYNCH. MOTOR

1—400 HP Westinghouse Synchronous Motor. 3/60/2300/900 RPM. Unity P.F. with direct connected exciter—Late Type.

55" LIFTING MAGNETS

2—55" Cutler Hammer Magnets 250 Volts DC. Excellent Condition.

350 KW GENERATORS

2—350 KW General Electric Generators Type MPC, 250 Volt DC, 720 RPM Single Bearing Machines.

MOTORS

60-50-25 Cycle in Stock—All Sizes. Slipring—Squirrel Cage—Synchronous. All types of Control Equipment.

100 HP Westinghouse Slipring 3 Bearing 3/60/220/440/435 RPM.

100 HP Gen. Electric Type I form K 3 60 2300/600 RPM.

100 HP Gen Electric Type KT 356 3 60 2200 900 RPM.

125 HP Gen. Electric Type I form K 3 60 440/720 RPM.

125 HP G. E. Type KT 3/60/2300/1200 RPM.

150 HP G. E. Type KT 3/60/440/500 RPM.

150 HP Gen. Electric Type I form K 3/60 2300/900 RPM.

200 HP Gen. Electric Slipring Type I form M 3/60/440/600 RPM.

200 HP G. E. Type KT 3/60/440/600 RPM.

250 HP G. E. Type KT 3/60/440/720 RPM.

T.E.F.C. MOTORS

60 HP Westinghouse CS-607 3/60/440/900 X Proof

50 HP Ideal New. 3/60/220/440/1800

2—20 HP Louis Allis ES. 365 3/60/220/440 1800 X-Proof

15 HP Louis Allis EX-364 363 220 440/1800 X-Proof.

125 VOLT DC MOTORS

1—100 HP Crocker Wheeler 125 Volt DC 850 RPM Ball Bearing

1—150 HP Crocker Wheel 125 Volt DC 850 RPM Ball Bearing.

Will make 1200 RPM 125 Volt Generators.

DC CIRCUIT BREAKERS

1—1000 AMP. Condit. 2 Pole

1—1600 AMP. Condit. 2 Pole

1—1600 AMP. Westinghouse 2 Pole

1—3000 AMP. Westinghouse 2 Pole

333 KVA TRANSFORMERS

4—333 KVA Gen. Elect. Transformers Type H Form VRW Primary 2400/4800 Secondary 240/480 Single Phase 60 cycle with Taps Immediate Shipment.

REBUILT TRANSFORMERS

3—100 KVA Pittsburgh 1/60/4800/230/460

3—75 KVA Pittsburgh 1/60/2300/4000Y/230/460

3—50 KVA Moloney 1/60/4800/230/460

3—50 KVA Westinghouse Type S. 1/60/2300/230/460

3—100 KVA G.E. 1 ph., 60 cy. 2400/4160 pri. 120/240 sec.

3—1667 KVA Wagner 1 ph., 25 cy., 23,000 pri., 575 sec.

ERIE ELECTRIC CO., INC. 124 CHURCH ST. BUFFALO, N. Y. CL. 4758

COMPLETE POWER PLANTS

STEAM — ELECTRIC — HYDRO — DIESEL

"Export Orders Carefully Executed"

FOR IMMEDIATE DELIVERY

TURBO-GENERATORS—Condensing—500 to 20,000 KW; some extraction type, pressures 200 to 450#. *ON WHAT SIZE SHALL WE QUOTE?*

TURBO-GENERATORS—Non-condensing—300 to 3000 KW. 150# to 450#. some extraction with high back pressure. *WHAT SIZE INTERESTS YOU?*

STEAM GENERATORS—30000# to 100000# per hr. 150# to 450#.

BOILERS—Water Tube, Stirling & Straight Tube types 200 to 450#.

Special 2 500 H.P. B&W Co. Stirling Boilers 200#—excellent condition.

BOILERS—Fire Tube, 100 to 300 HP. 100 to 250#. *WHAT BOILERS?*

TRANSFORMERS Quick Delivery. Various Sizes Rebuilt like NEW—Guaranteed.

Motor-Generators, Rotaries, Frequency Changers, Large Motors & Diesel Generators.

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COMPLETE DIESEL PLANT

3—Fairbanks Morse units. 805 HP—556 KW; 690 HP—473 KW; 300 HP—200 KW. Model 33-E-14. 3/60/2400 volts. New 1940. Will sell all or part. With auxiliaries. Condition excellent.

MISSISSIPPI VALLEY EQUIPMENT CO.
507 Locust St. St. Louis 1, Mo.

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Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

1—70x200' Steel for Bldg. w/runway
1—160 HP 125# Dutton Boiler—1951
1—250 & 150 HP Self-cont. Boilers
1—16 KW Ind. Elec. Melting Furnace
1—100 & 50 KW Motor Gen. Sets
1—150 HP 1200 & 1800 RPM Motors
2—200 Ton Steel Storage Bins

H. & P., 6719 Etzel, St. Louis 14, Mo.

Immediate Delivery in All Types of

BOILERS

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We own and offer the following types of equipment now located at our warehouse:

1—50 H.P., 150 lb. Clayton Package Boiler
Erie City Economics—125, 170, and 200 H.P.
Fire Box Boilers—165 H.P.
Package Type Boilers—18, 30, and 100 H.P.
2 New Frederick Stokers—2500 lbs. of coal/hr.

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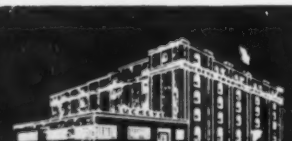
Anything in ELECTRICAL EQUIPMENT

SEND IN YOUR INQUIRIES



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LARGEST STOCK IN MIDWEST
1015 to 1021 PAPIN STREET CHESTNUT 2110 ST. LOUIS 2, MISSOURI

GET MORE FOR YOUR MONEY FROM HEMPHILL GUARANTEED EQUIPMENT

GUARANTEED GOOD BECAUSE REBUILT AND TESTED BY HEMPHILL ELECTRICAL ENGINEERS

TRANSFORMERS—60 Cycle

Qu.	KVA	Make	Type	Ph.	Voltages
1	1500	GE	Pyranol	3	4150x2400
2	750	GE	HT	3	4150Yx120/240
1	500	Kuhl	OISC	1	4600x2300
2	400	Pitts.		1	2400/4800x240/480
1	333	GE	OISC	1	13200x220/440
3	333	West	OISC	1	2300/575
1	225	Stand	OISC	1	440x220
1	200	GE	HT	3	2300x220
1	200	Pitts.	ODSC	1	4000x110/220
1	200	Mal.	C	1	2300x220/440
2	200	Al. Ch	OISC	1	480x120/240
2	150	Pitts.	OISC	1	240x120/240
3	100	West		1	13,200/-220/440
3	100	Wagner	HEB	1	240x120/120
1	100	Amer.		1	15000x2300
3	100	GE	Auto	1	4150Y2400Y
9	50	GE	H	1	13750x125x216Y
1	50	Al. Ch	ODSC	1	13530x120/240
2	50	Pitts	Sub	1	13530x120/240
1	50	Amer.	OISC	1	6600/13200x220/440
1	50	Amer.	WF	1	240x240/30
1	50	GE	KS	1	2300x230
3	50	GE	H	1	440 pri. 120/240 sec.
1	37	GE	H	1	2200x110/220

SYNCHRONOUS MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	300	El. Mach.	720	TEFC	2200
1	150	GE	720	ATI	2300
1	150	GE	1800	TS	220
1	150	Whse.	900		220

MOTOR GENERATOR SETS

Qu.	KW	Make	Speed	DC	AC
1	1000	GE	514	600	2300/4150 Syn.
1	150	GE	120	125/250	2300 Syn.
1	150	Whse.	600	125	4150 Syn.
1	125	CW	1200	125	220/440 SC
1	100	GE	900	250	2300 Syn.
1	94	GE	1200	60	4150 Syn.
1	30	GE	900	230	220 Syn.
2	30	GE	1200	125	440 SC.

SLIP RING MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	1750	GE	3600	K	4160
1	500	GE	900	IM	440
1	400	Whse.	450	CW	550
1	250	Whse.	600	CW	440
1	200	GE	1800	MT	2300
1	200	Whse.	600	CW	440
1	200	GE	600	MT	440

SLIP RING MOTORS—(Con't)

1	100	GE	400	IM	440
1	75	GE	1200	MT Vert.	220
1	60	GE	1750	MT	220
1	60	GE	900	MT	440
1	50	GE	1720	MT	220
1	50	Whse.	900	CW	220
1	50	GE	1700	MT	220
1	50	GE	600	MT	220
1	40	GE	1200	MT	220

REDUCTION GEAR

1—150 H.P. Terry Reduction, ratio 5.4:1 type XA 435 input 80 output RPM

SPECIAL WELDING

1—150 KVA GE, type KWC, 1 ph., 550 V, sec. 12.22/6.05 V, Thryatron Spot and Seam, Control CR 7503

SPECIAL M.G., A.C. WELDER

1—176 KVA Whse., 220 V. 57 PF, 1200 RPM, 1 ph., with 75 HP Slip Ring, 440 V, type CW, Exc. & Control w. flywheel.

"FOR POWER"
J.L. HEMPHILL & CO.
1604 53rd STREET, NORTH BERGEN, N. J.
PHONE NEW YORK—LONGACRE 3-3377
PHONE NEW JERSEY—UNION 3-2600

Member of the National Industrial Service Assn., Inc.

BARGAINS IN STOCK

3—600 amp. Gen. Elec. outdoor circuit breakers 750,000 amp. I.C.
Transformers all sizes.
2000 KW. 3-60-2300 G.E. Turbo-Gen. cond.
1000 KW. 3-60-480 G.E. Turbo-Gen. ext.
750 KW. 3-60-600 G.E. Turbo-Gen. ext.
500 KW. 3-60-480 G.E. non condensing.
1800 Sq. Ft. C. H. Wheeler surface condenser. C. H. Wheeler air ejector.
806 Cu. Ft. Chicago Pneumatic Compressor.
500 KW. 250 v. Gen. Elec. rotary.
2000 Amp. 8 volt Plater.
100 KW. 250 volt Motor-Generator.
150 KW. 250 volt Motor-Generator.
500 KW. 250 volt, 900 RPM. Generator.
75 KW. 125 volt motor generator.
50 KW. 3-60-440 Caterpillar diesel.
30 KW. 3-60-220 Ready Power Plant.
Large Stock: 110 and 220 volt DC motors, constant and adjustable speed.
Thousands of 3 phase motors, all types and sizes.
Oil Circuit Breakers.
Line Voltage Regulators.

What Have You For Sale—
What Do You NEED?

KEYSTONE POWER PLANT EQUIPMENT CO.
8403 HEGERMAN ST., PHILA. 36, PA.

AVAILABLE 450 KVA 13200 to 115/230 volt SUBSTATION 700 & 450 HP 80 rpm 4160 volt UNUSED SYN. motor Ball mill torque
3—600 Amp. 15 kv G.E. metalclad switchgear units.
1—37½ KVA 240/480 V. Caterpillar Diesel Gen. set.
WANTED 2—1000 KW 250 volt DC 175 lb. Con. turbines.
3—300 KW Rectifiers 4160 or 480 AC to 250 V. DC.
H. BLANE JOHNSON & ASSOCIATES
53 W. JACKSON BLVD., CHICAGO 4, ILL.

BOILERS

ALL SIZES — TYPES — PRESSURES — *A few of our offerings*

2—150 H.P., 165# w.p. Scotch Marine Boilers
Various size PACKAGE UNITS available
1—250 H.P.—250# W.P.—Wickes Boiler (Bent Tube) stoker fired, with superheater and forced draft fan, stack, all trim and controls.
ALL BOILERS ASME AND NATIONAL BOARD CODE.
1—50,000 lbs. per hour sectional steel header watertube Boiler, 275 P.S.I.
2—500 H.P. sectional steel header watertube Boilers, 250 P.S.I.
1—1000 KW Condensing Turbo Generators
2— 300 KW Condensing Turbo Generators
1—1000 KW non condensing Turbo Generators
1— 150 KW Gasoline Engine Generator Set.

PRICES AND PARTICULARS ON REQUEST
We buy entire power plants. What have you to offer?

HOWE BROTHERS
342 MADISON AVENUE
NEW YORK 17, N.Y.
MUrray Hill 2-8562

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NEW TRANSFORMERS
OIL COOLED
AIR COOLED
PHASE CHANGERS

ARROW TRANSFORMER CO., INC.
1932 E. Westmoreland St., Philadelphia 34, Pa.
GArfield 5-0433

USED TRANSFORMERS
REWOUND
REBUILT
RECONDITIONED

WORLD'S LARGEST INVENTORY

NEW AND GUARANTEED REBUILT EQUIPMENT

WRITE, WIRE OR PHONE

ELECTRIC EQUIPMENT CO.
L. D. (Long Distance) 65
ROCHESTER 1, NEW YORK

Explosion Proof Motor Headquarters

DIESEL GENERATOR SETS

100 KW General Motors Model 3-268A direct coupled to: Westinghouse Alternators, 3/60/440 V., 1200 RPM. Inc. Switchboards. Rebuilt.
60 KW General Motors set, Model 6-71, 6 Cyl., 3/60/120/208 V., 1200 RPM.
50 KW Int'l. Harvester set, Model UD-14, 4 Cyl. 3/60/120/208 V. Rebuilt.

Other sizes in stock, AC & DC Units

ALJON ELECTRIC DIESEL CO.
904 Pacific St., Brooklyn 16, N. Y.
STerling 3-6515

SWITCHGEAR • TURBO-GENERATORS • TRANSFORMERS

10,000 KVA TRANSFORMER BANK — **3—3333 KVA 1 Ph. 60 Cy.**
66000 to 33000 and 13200 volts Westinghouse

1800 KVA 3 PHASE TRANSFORMER — **6600 to 440 volts 60 Cy.**

OTHER TRANSFORMERS 1 PH. 60 CY.

2—1000 KVA 13800/2300 V.
6— 200 KVA 33000-2300/4600 V.
7— 100 KVA 33000—2300/4600 V.
3— 75 KVA 2400-240/480 V.
3—37½ KVA 2400-120/240 V.
80— 10 KVA 2400-120/240 V.
19— 7½ KVA 2400-120/240 V.
36— 5 KVA 2400-120/240 V.

OUTDOOR OIL CIRCUIT BREAKERS

1— 600 A. 110 KV GE FK0136
1— 400 A. 73 KV West. G-1
3— 400 A. 37 KV GE FK0136
1— 400 A. 37 KV West. 0221
1—1200 A. 15 KV GE FHK0236
1— 600 A. 15 KV West. 0221
1— 600 A. 15 KV Condit 0-1

OUTDOOR POTENTIAL TRANSFORMERS

13—33000/110 V. 200 V—A GE E116
3—33000/110 V. Westinghouse

INDOOR OIL CIRCUIT BREAKERS

1—2000 A. 15 KV 500 MKVA West. CO-11
9—1200 A. 15 KV 500 MKVA West. CO-11
1—1200 A. 15 KV 150 MKVA West. B20B
1— 800 A. 15 KV 130 MKVA West. B20
12— 400 A. 15 KV 130 MKVA West. B-20
1—2000 A. 4500 V. GE K-34

Galvanized Steel Substation Structures — Air Break Gang Operated Switches 73 KV, 37 KV & 15 KV — Outdoor & Indoor Disconnects

TURBO-GENERATORS IN STOCK

1—6250 kva 500 kw 3600 rpm Allis-Chalmers 200 lbs. 100° SH Condensing. Will operate 275 lbs. 615° TT without change. Generator 3/60/11500—can be changed to 2400/4160 V. Complete auxiliaries—can be operated for inspection. Checked by factory engineer in Sept. 1951—no repairs required.
1—1567 kva 1250 kw 3600 rpm Allis-Chalmers 150 lbs. condensing. Will operate 200 lbs. 450° TT without change. Generator 3/60/2300. Complete auxiliaries.
1—1250 kva 1000 kw 3600 rpm Westinghoues 185 lbs. 100° SH condensing 3/60/2300. Completely reworked, generator has new winding. Complete auxiliaries.
1—937 kva 750 kw 3600 rpm General Electric 150 lbs. condensing. Generator 3/60/2300.
1—625 kva 500 kw DeLaval geared 5000/900 rpm 150 lbs. condensing. Generator 3/60/2300. Can operate 275 kw 10 lbs. BP without change.
1—187½ kva 150 kw Westinghouse geared 7200/900 rpm 150 lbs. 100° SH non-condensing. Generator 3/60/240.
1—125 kva 100 kw West. geared 7200/900 rpm 150 lbs. non-condensing 3/60/240.
1—1500 kw 3600 rpm 3/60/2300 Gen. Elec. 140 lbs. non-condensing.
1—1000 kw 3600 rpm 3/60/2300 Gen. Elec. 140 lbs. non-condensing.
1—500 kw 3600 rpm GE non-condensing 175 lbs. throttle 30 lbs. BP 3/60/2400.

TAMPA ARMATURE WORKS

TAMPA ARMATURE WORKS, INC.
"Industry's Friend"
401 S. MORGAN ST. PHONE 2-1966 TAMPA, FLORIDA

STEAM TURBINE FOR SALE

825 K. W., 240 Volt Allis-Chalmers Turbine Unit operate at 300 pounds gage—620° F. Total Temperature—Condensing and Extraction. May be seen in operation through January, 1953.

FS6276, POWER
330 W. 42 ST., NEW YORK 36, N. Y.

FOR SALE

3—500 KW 480/3/60 diesel engine generator sets with switchboards, in same power house, excellent condition. Available immediately.
3—500 KW 480/3/60 diesel engine generator sets with accessories in same power house—extremely low price for quick sale. Also many other sizes.
2—30" Belt Conveyors complete with pulleys—idlers etc.—one 2400 ft.—other 1750 ft.

SOUL CLINIC INC.
CALGARY, CANADA

BOILERS—TURBINES—ENGINES and AIR COMPRESSORS

Boilers 50-2000 HP; Turbo Gen. 100-6000 KW; St. Eng. Gen. 75-1000 HP. Write for our Free New List of High Grade Used Equipment.

BENJAMIN W. BISSELL, Reg. Engineer
610 K of P Building, Indianapolis 4, Ind.
Phone Lincoln 4007

FOR SALE
18 NEW TURBINES

4 horizontal, 14 vertical, Westinghouse

Driving forced draft blowers—capacities ranging from 39000 to 56000 CFM and 16" to 24" pressure. Steam pressures 360 to 575#, back pressure 10#.

Will sell turbines separately if desired. *Price reasonable.*

Also—1—250 KW GE turbo generator unit, 3 phase, 60 cycle, 440 volt. Used one year.

G. M. DeROSE
2457 WOODWARD AVE.
408 DONOVAN BLDG.
DETROIT 1, MICH.

AIR COMPRESSOR

1—Ingeroll-Rand size 14½ x 14½ x 10 Class XRE single stage, direct conn. air compressor, 35# press. with 5 step clearance control, 150 H.P., 360 R.P.M., 440 volt, 3 phase, 60 cyc., 80% power factor, 50°C. engine type synch. motor, comp. with all auxiliary equipment. New 1950.

DALTON SUPPLY CO.
2829 Cedar St. Phila. 34, Pa.

EXISTING
BOILERS
10 to 5000 HP — 10 to 900 PSI
Diesel Engine — Steam Turbine
GENERATORS

DEAN G. STRICKLER & ASSOCIATES
5220 Pennington Ave. 1346 Conn. Ave.
Baltimore 25, Md. Washington 6, D.C.
Curtis 4434 DuPont 7-3386

NEW & REBUILT POWER EQUIPMENT—READY TO SHIP!

A. C. MOTORS

220/440 Volt 3 Phase 60 Cycle

H.P.	Make	RPM	Type
525	Elliott	720	Syn.
450	Elliott	720	Syn.
400	Westg.	600	CS-1214
350	Westg.	400	CS
350	Westg.	585	CS
300	Westg.	450	CS-1214
300	G. E.	1800	2200/4100 V.
250	Burke	720	Syn.
250	G. E.	1200	KT-563
225	Elec. Machy.	1800	Syn.
200	Westg.	291	CS-1214A
200	Wagner	1800	RP
200	G. E.	1800	Syn.
175	Westg.	720	CS
150	Westg.	257	Syn.
150	Westg.	585	CS
150	Westg.	600	Syn.
150	Cr. Wh.	860	
150	Elec. Prod.	900	Syn.
150 New	Reliance	1200	AA-6085S
150	G. E.	1750	2200 V.
150 Vert.	G. E.	1750	2200 V.
150 New	Westg.	1760	2300 V.
150	Wagner	1800	Tot. Enc.
125	Elec. Mach.	164	Syn.
125	Cr. Wh.	720	
125	Westg.	1200	Syn.
125	Wagner	1150	RP
125	Westg.	1750	CS-761C
100	Cr. Wh.	600	
100	Wagner	860	
100	G. E.	900	I-K
100 New	Reliance	1170	TEFC
100 New	Reliance	1170	AA-5084S
100 New	Reliance	1800	TEFC
100 New	Reliance	1800	
100	G. E.	1800	K-504S

A.C. MOTORS (Con't.)

100	Westg.	1800	Syn.
75 New	Reliance	875	AA-5084
75	Elec. Machy.	900	Syn.
75 New	Reliance	1170	TEFC
75 New	Reliance	1170	AA-505
75	Westg.	1175	CS-607
75	G. E.	1800	I-K
75	Louis Allis	1800	Splash Proof
75 New	Reliance	1800	TEFC
60	G. E.	900	KT-542
60	Westg.	1200	CS

SLIP RING MOTORS

220/440 V. 3 ph. 60 cy.

H.P.	Make	RPM	Type
400	Westg.	438	2200 V.
350	G. E.	710	MT-575
200	G. E.	600	IM-2200 V.
200	Westg.	500	CW
200	Crocker Wh.	590	
150	G. E.	705	IM-2200 V.
150	Westg.	1140	CW-873C
75	Westg.	870	CW
60	G. E.	570	MTC
50	G. E.	865	MT-346
50	Westg.	1160	CW-642C

IMMEDIATE DELIVERY AIR COMPRESSOR

876 cfm Chicago Pneumatic 100 lb. pressure 2300 or 440 v. A.C. syn. motor complete with starting equipment.

TRANSFORMERS—1 Ph. 60 Cy.

No.	KVA	MAKE	PRIM.	SECONDARY
10	25	G.E.	2200	110/220
9	37½	G.E.	2200	110/220
3	75	West.	2400	120/240

TRANSFORMERS (Con't.)

1	75	West.	13200/6600	2300
1	75	Pgh.	4600	115/230
1	100	Pgh.	2300/4600	115/230
6	100	Pgh.	4600	115/230
2	150	Pgh.	4600	115/230
1	150	G.E. (3 Ph)	2200	240/480
3	200	All. Chal.	22000	2300
3	200	Pgh.	25000	460
2	250	G.E.	2400	480

FORK LIFT TRUCKS

8—CLARK "UTILITRUC 6025" Gasoline powered —10¾" Fork Lifts—6000 lb. capacity—Excellent condition.

PLATING & WELDING SETS

1—48 kw. 6000 amp. @ 8 volt, 3000 amp. @ 16 v. Electro Products D.C. Generator double commutator, dir. con. to 75 H.P., 220 v. 3 ph. 25 cy. Syn. A.C. Motor.

DC VARIABLE SPEED MOTORS

230 Volts

HP	MAKE	RPM	TYPE
400	All. Chal.	400/1200	
125	Westg.	125/500	BB Anti-Fric.
75/100	Westg.	600/1200	SA-13L-8B
50	G.E.	600/1200	LC
50	Crkr. Whlr.	1500/200	CMC-8B
50	Westg.	350-1050	SK-170
40/50	Reliance	600/1200	T-310
40/50	Reliance	500/1500	T-461T BB
40	Westg.	750/1500	SK-140
40	Reliance	500/1500	T-461F TEFC BB
40	Reliance	400/1600	T-615F TEFC BB
40	El. Gen. Co.	385/1200	Frame 180S
35	G.E.	625/2100	COM-1829 AE
35	G.E.	350/1400	RF-162 SS
30/40	Imperial	400/1600	D-D69 BB DP
30/40	Reliance	300/1200	T-651 TE BB
30	Reliance	400/1600	T-461F TEFC BB
25/30	Reliance	500/1600	T-262T
25	Westg.	400/1600	SK-133
25	Westg.	400/1200	SK
15	Westg.	400/1600	SK-110L
25	Reliance	400/1600	T-310F TEFC BB

WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US.

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

POWER PLANT EQUIPMENT

SPECIAL OFFERINGS

TURBO-GENERATORS

1—20,000 KW, 200# 13,200 V.
1—10,000 KW 200# 13,800 V.
1— 5,000 KW 275# 11,500 V.
1— 4,000 KW 400# 2300 V.
1— 3,000 KW 425# 13,200 V. Ext. 170# Non Cond.
1— 3,000 KW 175# 550 V. Cd.
1— 1,500 KW 150# 2300 V. Cd.
1— 1,500 KW 175# 550 V. Ext.
1— 1,250 KW 250# 2400 V. Ext.
1—1,000 KW 200# 4160 V. N.C. NEW 1949.
2— 750 KW 150# 250 V. D.C.
1— 500 KW 200# 4160 V. N.C.
1— 300 KW 125# 250 V. D.C.
2— 120 KW 150# 240 V. N.C.

DIESEL GENERATORS

1—1000 KVA 2400 volts
3— 500 KW 480 volts
1— 400 KW 480 volts
1— 300 KW 2400 volts
2— 75 KW 240/480 V.

BOILERS

2—50,000# 275# (1949)
3—15,000# 275# (1945)
1—300 H.P. 250# (1938)
2—250 H.P. 200# (1940)
1—84" HRT 150# (1942)

CRANE

1—16 Ton Span 30'-10½" Hand operated

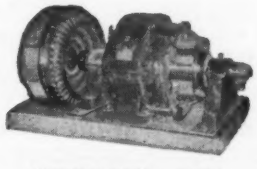
Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.

THE BUYERS MUST BE SATISFIED—ALWAYS

LATE TYPE MOTOR — GENERATOR SET

500 KW, 240 volt D.C., 900 RPM. Westinghouse Compound Wound. Serial No. 4079932. 714 HP. Syn. Motor 3/60/2200 volt, 80% P.F. Serial No. 4079926. With Mag. Reduced Voltage Starter. Factory Built Set.



MECHANICAL SPEC.

Base: 125¼" long and 59" wide
Overall Height: 60¾"
Weight: 21,600 lbs.

BENSON-WILIMZIG, INC.

1708 North Eighth St., St. Louis 6, Mo.
Phone Garfield 4290

COMPRESSORS Rebuilt by AMERICAN

Stationary			*Portables*
CFM	*LBS*	*MAKE*	
66	100	I.R.	30' Worthington
93	100	I.R.—C.P.	60' Worthington
129	100	I.R. ES	85' Ingersoll Rand
166	135	I.R. ES	105' IR—Worth
173	100	I.R.	160' Worthington
210	100	I.R. ES	210' Worthington
254	125	I.R.	315' Worth—I.R.
368	100	I.R.	500' Worth—I.R.
528	100	I.R.	600' Worthington
60	250	Bury	
310	600	Worth	
15	1000	I.R.	
110	3000	I.R.	

Have your compressor rebuilt by compressor men

Sell • Buy • Trade • Rent

AMERICAN AIR COMPRESSOR CORP.

Dell Ave. & 47th Street
North Bergen, New Jersey

UNIFLOW GENERATOR UNIT

3 Phase 60 Cycle

750 KVA Allis generator, 240/480/600/2300/4160 volts, 277 rpm direct connected to Ames vertical uniflow steam engine.

Still installed—Excellent condition.

GASOLINE GENERATOR UNIT

3 Phase 60 Cycle

75 KVA G.E. generator, 240/480/600/2300 volts, 1200 rpm driven by 100 HP Winton gasoline. engine.

Still installed—Excellent condition.

GENERATORS

3 Phase 60/240 Cycle

2500 KVA G.E. 60 cycle 2400/480 volts, 3600 rpm.
2859 KVA (3) G.E. 240 cycle 4160 volts, 4800 rpm.
4600 KVA G.E. 90 cycle 2400 volts, 5400 rpm.

INDUCTION MOTORS

3 Phase 60 Cycle

30 HP G.E., type KT, 2300 volts, 720 rpm.
32/50 HP West., 440 volts, 695/875 rpm, ball bearing.
50 HP West., 2300 volts, 875 rpm, ball bearing.

Write, wire or phone:

INTERNATIONAL POWER MACHINERY COMPANY

Union Commerce Bldg., Cleveland 14, Ohio
Telephone: MAin 1-9514

SLIP RING MOTORS

220 or 440 volt, 60 cycle, 3 phase, slip ring Motors Rebuilt

H.P.	Make	Type	Speed	Description
400	G.E.	I-M	1200	S.B.
300	G.E.	I-M	1200	S.B.
200	G.E.	I-M	1200	S.B.
150	G.E.	I-M	1200	S.B.
150	G.E.	I-M	1800	S.B.
100	G.E.	MT-300	1800	S.B.
100	G.E.	I-M	900	S.B.
100	G.E.	I-M	720	S.B.
75	G.E.	MT-343	1200	S.B.
75	G.E.	I-M	900	S.B.
75	West.	CW	720	S.B.
75	G.E.	I-M	720	S.B.
60	G.E.	MT-333	1800	S.B.
40	G.E.	I-M	1800	S.B.

BRAND NEW SQUIRREL CAGE MOTORS

Totally enclosed, fan cooled, explosion proof, open 220 or 440 Volt, 60 Cycle, 3 Phase

H.P.	Make	Type	Speed	Description
150	G.E.	K-6326	3600	TEFCBB
150	G.E.	K-6326	1800	TEFCBB
125	G.E.	K-6326	1200	TEFCBB
100	West.	CS-6075	1800	TEFCBB
100	West.	CS-504	1800	B. B. open
75	West.	CS-504	3600	TEFCBBXP
75	A.C.	ARZ	1800	TEFCBBused
75	West.	CS-504	1800	TEFCBBXP
75	West.	CS-445	1800	B. B. open
75	F.M.	QS-445	1800	B. B. open
75	West.	CS-505	1200	TEFCBBXP
60	West.	K-5945	1800	TEFCBBXP
60	G.E.	OG-44	1800	TEFCBBXP
60	L.A.	QS-444	1800	B. B. open
60	F.M.	FB-404	3600	B. B. open
50	Master	K-445	1800	TEFCBBXP
50	G.E.	K-405	1800	TEFCBB
50	G.E.	CS-445	1200	S. B. drip
50	West.	K-505	900	S. B. open
50	G.E.	AR-444	3600	TEFCBBXP
40	A.C.	KF-365S	3600	TEFCBBXP
40	G.E.	CS-405	1800	B. B. Splash
40	West.	K-405	1800	TEFCBB
40	L.A.	404	1800	TEFCBBXP
40	G.E.	CS-504S	1800	B. B. open

REBUILT SQUIRREL CAGE MOTORS

220 or 440 Volt, 60 Cycle, 3 Phase, Open

H.P.	Make	Type	Speed	Description
200	Wagner	RP-2-26	1800	S. B.
200	Wagner		1200	S. B.
200	G.E.	K-564	900	B. B. new
150	West.	CS	1800	S. B.
150	G.E.	I-K	1200	S. B.
150	G.E.	I-K	720	S. B.
100	West.	CS	1800	S. B.
100	G.E.	I-K	1800	S. B.
100	G.E.	I-K	1200	
100	G.E.	KT-347	1200	S. B.
100	West.	MS	1200	S. B.
100	West.	CS	900	S. B.
100	G.E.	I-K	720	S. B.
75	West.	CS	1800	S. B.
75	West.	CS	1200	S. B.
75	G.E.	I-K	900	
75	G.E.	KT-343	1200	S. B.
75	West.	CS-WL-607	1200	S. B. B.
75	G.E.	KT-552	900	S. B.
75	G.E.	KT-352	900	S. B.
75	G.E.	KT-346	720	S. B.
60	G.E.	KT-333	1800	S. B.
60	G.E.	I-K	1200	S. B.
60	West.	CS	1200	S. B.
60	G.E.	KT-346	900	S. B.
60	G.E.	I-K	900	S. B.
50	G.E.	I-K	1800	S. B.
50	Cr. Wh.	25R	1800	S. B.
50	G.E.	KT-327	1800	S. B.
50	G.E.	KT-336	1200	S. B.
50	West.	CS	1200	S. B.

We have in stock explosive proof motors 220/440/60/3 ranging in HP from ½ to 50 HP 900 to 1800 RPM. We also carry in stock a large quantity of used electric motors from 1 HP up to 500 HP., generators, transformers and control equipment. Upon receipt of your inquiries, we shall be glad to quote.

POWER
EQUIPMENT COMPANY
8 CAIRN ST., ROCHESTER 2, N. Y.
P. O. BOX 534 — Tel: Genesee 5629

TRANSFORMERS AND POWER EQUIPMENT

For Immediate And 1952 Delivery
Subject To Prior Sale

19,500 kva 115,000/66,650/40,000, will rewind to 13,800/3/60.
12,000 kva G.E. 115,000/13,800, 3/60.
1000 kva G.E. 12,000/2400/4160Y/3 substations complete.
5000 kva G.E., 66000 or 33000/13200
100 kva 33,000/22,000/2200/1.
150 kva 26,000/13,200/2300/575/1.
MINING EQUIPMENT, BALL MILLS, CRUSHERS, CLASSIFIERS, MINE RAILS & ORE CARS.
20,000 kva Turbine Generator.
6000 kva Diesel Generator built 1938.
1500 kva Hydro Electric Generator unused.
6600 h.p. Electric Motors.

ELECTRIC MOTORS

3500 hp Squirrel cage, 120 rpm, 2300 volts
2500 hp Slip ring, 6600 volts
1500 kva Synchronous, 900 rpm
1000 hp Synchronous, 1800 tri clad
800 hp Slip ring
300 hp Slip ring, 705 rpm, 2300 volt
250 hp 3600 rpm, 440 volt, drip proof
75 hp Slip ring, 900 rpm
HYDRO SETS 60 and 25 cycle.
5—2000 kw 36 ft. head.
2— 750 kva 18 ft. head.
1— 200 kw 500 ft. head.
2—1000 kva 500 ft. head.
2—1400 kva 26 ft. head.
2 & 300 kw frequency changers.
WATER, FEED, AND FUEL PUMPS
10x8 Byron Jackson centrifugal
8x6 Kingsford Smith centrifugal
Unused Worthington Diesel Pumps 425 h.p.
1000 PSI 22500 Barrels
B & W Centrifugal 14"x12", 5414 gpm, 270 ft. head, 500 h.p., 2200 volt motors built 1938 used.

ALL 60 CYCLE GENERATORS

2 only—1700 kva 360 rpm 2400 volt at 0% P.F. lead
1000 kva at 0% P.F. lag
2 only— 750 kva, 480 volt, 750 rpm
1 only— 360 kva at 750 rpm, 480 volt
1 only— 750 kva at 750 rpm, 480 volt
1 only— 200 kw at 550 volt, 600 rpm
1 only— 312 kva at 2300 volt, 720 rpm
1 only—1000 kw 200 rpm, 2200 volt
3 only—2000 kw 180 rpm, 2200 volt

Write, Wire or Phone

VANCOUVER SALES & APPRAISALS LTD.
846 BEACH AVE. Phone: MArine 7254
VANCOUVER, B. C. CANADA

50000 LB. PER HOUR WATER TUBE BOILER

FOR IMMEDIATE SALE

Forged Steel sectional header cross drum watertube boiler including steam trim designed for 450 lbs. pressure, 600 degree superheat with 7200 sq. ft. of heating surface—delivery in the first quarter of 1953. New Forged Steel sections with generating and circulating tubes supplied by Babcock & Wilcox Company installed in 1949—New Superheater elements purchased from Combustion Engineering-Superheater, Inc. Installed in 1949. This boiler is now in service in Chicago area steel plant and is being removed because of an expansion program involving larger capacities—It is priced attractively on an "As Is" "Where Is" basis for an early acceptance. Due to sectional design low cost proposal can be provided for dismantling and reerection.

FS-5918, POWER
520 N. Michigan Ave. Chicago 11, Ill.

NOW LIQUIDATING

Equipment from Closed Brewery
Marion, Indiana

1—I-R 7x7 Air Compressor, 15 HP motor.
1—Carbondale 10x10 Vert. twin cylinder Ammonia Compressor, 82 ton, 75 HP motor.
1—Carbondale 9x9 Vert. twin cylinder Ammonia Compressor, 60 ton, 60 HP motor.
1—York 7½x7½ Vert. twin cylinder Ammonia Compressor, 45 ton, 60 HP motor.
1—Tabor Fermentation Gas Collector with 8 storage tanks 50 cu. ft., ASME 245± WP.
5—Niagara Spray Cooler and Fan Cooler Units.
1—Rotary Pump 5", with 40 HP motor, 1000 GPM —86' Hd.
3—Westinghouse Dry Type Transformers, 100 KVA & 150 KVA.
Lot of Welded Steel Storage Tanks (closed) 5500 gal., 10,500 gal., 11,300 gal. and 12,700 gal.
Lot of Welded Steel Tanks, 16'10" L x 7'7" W x 8'9" deep, open top, flat bottom.

FOR SALE FROM PHILA. STOCK

2—I-R Motorblowers, type FS-538; cap. 4000 CFM @ 3# Pr.
1—Penn Steam Booster Compressor 4x5
1—Terry Steam Turbine, 10 HP
1—Coppus Steam Turbine, 8 HP
1—Byron Jackson Bronze Deep Well Turbine Pump with 20 HP motor. 150 GPM.
1—I-R #5-ALV Bronze Centrifugal Pump with 40 HP motor. 850 GPM—140'.
1—I-R #1½-RVH Bronze Centrifugal Motorpump with 20 H motor. 200 GPM—200'.

PERRY EQUIPMENT CORP.
1422 N. 6th St. PHILA. 22, PA.

SEASON'S GREETINGS

On this, the Occasion of a New Year, Our Entire Staff Extends the Most Cordial Greetings to all our Friends and Customers . . . and hopes that their year '53 will be a prosperous and fruitful one.

AMERICAN CONDUIT SALES CO.
700 Berriman St. • Brooklyn 8, N.Y.
Dickinson 9-7400

FOR SALE

2—1240 H.P.

BADENHAUSEN BOILERS

Used during last heating season. Complete with coal pulverizers—motors—gas heat economizers. 100 H.P. centrifugal fan for each boiler. Makeup water preheater—100 H. P. steam turbine driven boiler feed water pump-elliott open type deaerating feed water heater 1—300 K.W. A.C. Generator. *Immediately available Philadelphia area.*

FS-6172, POWER
330 W. 42nd St., New York 36, N. Y.

FOR SALE

Murray Non-Condensing Turbo-Generator
75-KW, 80% PF, 220 V, 3 Ph.
Speed 1200
Pressure 200 PSIS, BF-10 PSI, w/Switch Board

J. FRED SCHMIDT PACKING CO.
253 E. Kossuth St., Columbus 6, Ohio

SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
500 (2)	2200	G.E.	900
500	2200	G.E.	450
450	440/220	Whse.	514
350	2200/440	G.E.	450
300	2200	G.E.	360
300	440	Whse.	3600
250	4000/2300	G.E.	450
250	440/220	Whse.	600
250	550/440	G.E.	1200
250	440	G.E.	600
200	440/220	Whse.	514
200	440	G.E.	450
188	4000/2300	G.E.	1800
150	2200/440	G.E.	600
150	440/220	G.E.	450
145	4000/2300	G.E.	1800
125	2200/440	G.E.	600
125	550/440	G.E.	1200
100	440/220	G.E.	600
100	440/220	G.E.	900

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	2200/440	G.E.	ATI	720
300	2300/400	G.E.	TS	720
300	440/220	G.E.	ATI	600
250	2200/440	G.E.	TS	1200
250	440/220	Whse.	HR	257
250	440/220	G.E.	ATI	600
240	2300/410	G E	ATI	720
200	4150/2300	Whse.	G	1800
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	410/220	Whse.	G	1800
75	2200/440	Whse.	GE	600

PLATING UNIT

1—5,000 amp., 4/6 volt (or 2,500 amps., 8/12 volts) A.P. Munning, double commutator dir. conn. to 50 hp. G.E. sq. cage motor.

Engine Generator Set

1—150 kw. 1200 rpm, 480/240 V., 3 ph., 60 cy., Whse., conn. to 240 hp, 1200 rpm, Sterling gasoline engine, practically new.

CIRCUIT BREAKERS

2—2000 amp., GG E., 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
1—400 amp., 7500 V., G.E., outdoor, new

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
650	2200	G.E.	FT	3600
500	2200/4000	Elliot	SC	1800
350	2200	G.E.	KT	1200
300	2200	G.E.	FT	3600
250	440	G E	IK	720
250	2200	Al.-Chal.	AR	1800
225 (2)	2200/410	G E.	KT	1200
200	2200/440	G.E.	K	1200
200	440	G.E.	IK	720
200	410	G E	IK	514
200	440/220	G.E.	KT	1800
150	220	Whse.	CS	1200
150	440	Multi sp.	KT	1800/600
150	440/220	G.E.	IK	450
150	440/220	G.E.	KT	720
150	440/220	Howell	B. Brg.	1800
150 vert.	440/220	G E.	KTP	1200
150	440/2200	G.E.	IK	514
150	2200/440	G.E.	KT	600
100	2200/440	G.E.	K	1200
100	2200/550	Whse.	CS	900

A. C. GENERATORS

1—320 kva, 660 rpm, 2300/440/220 V., G.E.
1—275 kva, 1200 rpm, 440 V., G.E.
1—250 kva, 720 rpm, 2300/440 v., G.E.
1—225 kva, 600 rpm, 220/440 v., G.E.
1—187 kva, 1200 rpm, 440 V., Whse.
1—150 kva, 900 rpm, 480/240 v., G.E.

D. C. MOTORS

HP	Volts	Make	Type	Speed
250	230 (2 new)	Cr. Wh.	CMC	1800
225	230	G.E.	CD	600
150	230	Whse.	SK	850
120	230	Whse.	SK	350/1050
100	230	El. Dyn.	30-3	475/1250
100	230	Cr. Wh.	CMC	625
100	230	G.E.	CD	1750
75	230	G.E.	CD	1150
75	230	Whse.	SK	850
50	230	Rel.	T	400/1200

MOTOR GENERATOR SETS

KW	Make	Input V., AC	Motor Type	Output V., DC
250	Whse.	2200	Syn.	250
175	G.E.	220/440	Syn.	230
150	Whse.	440	sq.ca.	250
100	Al. Ch.	2200/440	sq.ca.	240/120
100	Cr.Wh.	440	sq.ca.	250
75	G.E.	2200/440	syn.	125
65	G.E.	2200/440	sq-ca.	250
65	G.E.	2200/440	sq.ca.	125
60	G.E.	440/220	sq.ca.	250/125
45	G.E.	440/220	sq.ca.	250
40	G.E.	440/220	sq.ca.	250/125

TRANSFORMERS 60 CY.

1—1500 kva, Al. Chal., 11000—480 volts, 3 phase
1—1060 kva, G.E., 1200—440 V., 3 phase
1—300 kva, Al. Chal. 4600/4160—240/120 V., 3 phase
3—250 kva, G.E., 4000—230/460 V.
1—150 kva, Whse., SK, 1000 125/215 v., 3 ph.
3—150 kva, Al. Chal., 2400-240/120 V.
3—100 kva, Whse., 2400-240/480 V.
6—100 kva, Whse., 2400—120/240 V.
3—100 kva, G.E., 4150—120/240 V.
2—100 kva, Whse., 2400—120/55 V.
3—75 kva, Whse., 2400—240/480 V.
3—75 kva, Moloney, 4150—240 V.
6—50 kva., G.E., 2400—120/240 V.
11—50 kva, Whse., 2300-110/220 V., dr.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

COMPLETE DIESEL POWER PLANT

Consisting of

3 DIESEL GENERATOR SETS

1—430 KW, DeLaVergne Model VG Diesel, dir. con. to Gen. Elec. Alternator, 3/60/2300, 300 r.p.m. with Motor Dd. Exciter and Panelboard.

2—187 KVA DeLaVergne Model VG Diesels, dir. con. to West. Alternators, 3/60/2300, 300 r.p.m. with Dir. Con. Exciter and Panelboard

Still on original foundations. Excellent condition. Will sell as entirety or individually.

CONSTRUCTION & POWER MACHINERY CO.
270-23d St., Brooklyn 15, N. Y.
SOuth 8-4900

BOILERS

10 to 1000 H. P.

NEW-USED RECONDITIONED

Steam, Gas and Electric Power Equipment

J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK CITY
MURRAY HILL 7-8547-8-9

NEW DIESEL & TURBO GENERATORS

100 KW Diesel GM (desired Voltage)
200 KW Diesel 120/240 Volt DC
150 KW Turbo DC 120 V 180/275 Lb.
200 KW Turbo DC 120 V 140/175 Lb.
240 KW Turbo AC 450 V 420/615 Lb.

UNIVERSAL POWER EQUIP'T CO. INC.
50 Broad St., N.Y.C. WH 3-3292

VERTICAL PUMPS

Two at 1000 GPM VS 22' 1800 RPM 10 HP 3-60 220/440 with controls and fittings. Like new.

THE A. BENTLEY & SONS CO.
201 BELMONT AVE., TOLEDO 2, OHIO

A.C. GENERATORS

25—New 3 KW G.E. 3/60/120-208v/1800 RPM 2 Brg. B. Brg. w/Dir. Con. Exciter & Panel.
15—New 10 KW G.E. 3/60/120-208v/1800 RPM 2 Brg. B. Brg. w/Dir. Con. Exciter & Panel.
6—New 25 KVA G.E. 3/60/440v/1800 RPM.
4—50 KVA Burke 3/60/440v/1800 RPM.
2—75 KVA West 3/60/440v/1800 RPM.
7—75 KVA Elec. Products 3/60/440v/1800 RPM.
2—500 KVA Elec. Mach. 3/60/440v/900 RPM.

Partial Listing—Your Inquiries will receive our prompt attention.

ALBERT HELLER COMPANY
210 Snediker Ave. Bklyn., N. Y.
HY. 5-0800

FOR SALE

SLIP RING MOTORS
3 PHASE — 60 CYCLE

1—150 HP, 720 RPM, 220 or 440 Volt, Type ARY, Allis Chalmers.
1—100 HP, 1800 RPM, 2200 Volt, Type IM, General Electric with control.
1—75 HP, 1800 RPM, 208/220 Volt, Type WT505S, TEFC, Burke.
1—60 HP, 1800 RPM, 220 Volt, Type MT533, General Electric.
1—40 HP, 900 RPM, 220 Volt, Type MT342, General Electric.
1—25 HP, 600 RPM, 226 Volt, Type CW, Westinghouse with control.

FULL MAG. PRI. & SEC. SLIP RING CONTROLS

1—125 HP, 220 Volt, 3 phase, 60 cycle, General Electric, CR7122Y1.
1—100 HP, 220 Volt, 3 phase, 60 cycle, General Electric, CR 7122Y1.

REDUCED VOLTAGE SQUIRREL CAGE MOTOR CONTROL

1—150 HP, 440 Volt, 3 phase, 60 cycle, Size 6, General Electric, CR5335-B-3D.

All Attractively Priced

FLUSHING ELECTRIC CORP.
45-07 162nd St., Flushing 58, N. Y.
FL. 8-8700

STEAM POWER PLANT

5—714 HP Combustion Engineering WATER TUBE BOILERS, with Ebasco Superheaters, Sturtevant High Pressure Economizers, Green Chain Grate Stokers, Hagan Combustion Controls, Copes Feed Water Regulators, Clarage Forced Draft Fans, Sturtevant Induced Draft Fans, Smoke Stacks. Good for 250# pressure by Hartford.
1—705 HP Stirling 4 drum Boiler with B&W Superheater, Green Chain Grate Stoker, Sturtevant Economizers, Sturtevant Induced Draft Fan, with Smoke Stack. Good for 250# pressure by Hartford.
2—8000 HP Webster Water Heaters.
1—McCaslin Pivoted Bucket Conveyor System for handling coal and ashes. Approximately 300' long.
6—Steel Coal Bunkers, 80 tons each.
1—30" Wheeler Single Stage Circulating Pump, 30,000 GPM direct connected to 300 HP Allis-Chalmers Motor, 3/25/440, 300 RPM. (Has extra impeller for 15,000 GPM)
1—4"x8" Dayton-Dowd Centrifugal Pump direct connected to 125 HP General Electric-Curtis Steam turbine.
1—100 KW General Electric 125 Volt DC Generator direct connected to a General Electric-Curtis Steam Turbine, 2-stage with reduction gear, Type SC, 3000 to 1206 RPM.
1—Type 1A-60 Wheeler Turbo Air Pump direct connected to 75 HP General Electric-Curtis 2-Stage Steam Turbine, 1750 RPM.
1—6" Wheeler Centrifugal Condensate Pump direct connected to a 20 HP General Electric-Curtis 2-stage Steam Turbine, 1800 RPM.
1—Combination Circulating Pump and Condensate Pump driven by 100 HP General Electric single Stage Steam Turbine through a Westinghouse Reduction Gear, 3500 to 700 RPM
1—2" 2-stage LeCourtney Centrifugal Pump, 200 GPM 650' Head at 3700 RPM direct connected to 53 HP Westinghouse Steam Turbine.
1—3000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 750 RPM, 600 Volts DC with 1—3150 KVA General Electric Transformer, 3 phase, 25 cycle, 6600/13200-445 Volts with starting panel and all instruments.
1—1000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 750 RPM 600 Volts DC with 1-1050 KVA General Electric Transformer, 3 phase, 25 cycle, 13200/445 volts with starting panel and instruments.
1—500 KW Westinghouse Synchronous Converter, 6 phase, 60 cycle, 1200 RPM, 600 Volts DC with starting panel and instruments.
1—4000 KVA Westinghouse Transformer, 3 phase, 25 cycle, 13200/6600 volts.
7—700 KVA Westinghouse Transformers, single phase, 25 cycle, 7620/6600 volts to 11200 volts.
1—Kennecott Pressure Type Industrial Water Filter.
1—50-Ton Electric Traveling Crane—55'5½" Span.

Send for Complete Inventory

MORSE BROS. MACHINERY COMPANY
2900 BRIGHTON BLVD.
P.O. Box 1708, DENVER, COLORADO

1—400 H.P. Keeler C.P. Integral Type Water-tube Boiler with complete Todd Oil Burner installation. Design Pressure 160#. Built 1940.

2—500 HP Cleaver-Brooks, 200# pressure. No. 6 oil, complete with pumps and receiver. All trim.

1—150 HP Union Iron Works, 125# pressure, Universal type, 1940.

1—600 H.P. B&W Sec. Headers, Long. Drum Boilers, 225# w.p., ASME, built 1922.

2—500 HP Springfield Sec. Hdr. Cross Drum 250 lbs. Superheaters, etc., (1934)

1—490 HP Walsh-Weidner sec. Hdr. Cross Drum. 450 lbs. Superheater, etc.

1—250 H.P. Johnson Scotch Marine Boiler, 150# W.P., New in 1950. Fully automatic. No. 6 oil. With all auxiliaries.

1—615 HP Springfield sec. Hdr. Cross Drum. 275 lbs. Superheater. Stoker.

2—854 HP Springfield Sec. Hdr. 225 lbs. Superheaters, etc.

2—250 HP Erie City—3 Drum lowhead. 200 lbs. —a complete Plant 1946. 200# w.p. fully automatic mechanical Peabody burning equipment. 1—Pratt-Daniels Stacks, pumps and heaters.

2—310 HP Keeler "CP" Self-Contained. 160 lbs. With or without STOKERS. Complete Plant.

2—Babcock & Wilcox FF-15 Self-contained. 160 lbs. Complete Plant—16,000 lb. each.

2—750 HP B&W Sterling, new tubes, 1923, 225# w.p.

1—125 H.P. Erie City Economic, 125# pressure. Complete with stack and trim. 1946.

Miscellaneous Scotch Marine Boilers, 75 to 150 H.P. available.

A Number of Self-Contained & Economic Units, 50-150 H.P., 100-200 Lbs. Pressure.

2—Detroit Roto-Spreader Stokers for 300 H.P. Boilers, nominal rating.

Combustion Engrg., Spreader Stoker complete with fan & Hogan Controls-Stoker. Designed for 600 H.P. boiler at 200% of rating, or 1200 H.P.

1—Centrifugal Boiler Feed Pump 2500 g.p.m., 250# discharge pressure, direct connected to 75 H.P. 3/60/220/440 V motor, with starter. Pump used 6 mos.

1—750 K.W. and 1—500 K.W. DC 240 V Generators dir. conn. to 2—Westinghouse non-cond. Turbines—3600 r.p.m. reduced to 900 r.p.m. on generators. Includes switchboards.

2—Cleaver-Brooks Package Boilers, 100 H.P. and 125 H.P. resp., 125# and 150# w.p. New in 1947 and 1949.

1940—120 H.P., 125# Hodge Scotch Marine, hand fired with grates stack & controls. Located Massachusetts.

WARNER J. SHERB, INC.

342 Madison Avenue, New York, N.Y.

Telephone MUrray Hill 2-9098

MOTORS • M.G. SETS • TRANSFORMERS • COMPRESSORS

D.C. MOTORS—230 Volt

6—100 HP West. MCSA-18, Comp. 600 RPM.
1— 65 HP West. MCSA-12, Ser. 440 RPM.
1— 50 HP G.E. CD-1829, Ser. 750 RPM.
2— 25 HP West. 48A, Ser. 48 SRPM
1— 25 HP West. MC-40, Ser. 520 RPM.
3— 20 HP West. K-6, Ser. 515 RPM.
1— 19 HP G.E. MD406AE2, Ser. 500 RPM. NEW
2— 10 HP G.E. MD403AE2, Ser. 630 RPM. NEW
3—6½ HP West. MCSA-2, Ser. 730 RPM. NEW

AIR COMPRESSORS—100 PSI

1—1700 CFM C.P. Steam Driven. (150 PSI)
1—1600 CFM I.R. PRE-2, 300 HP, 2300 V.
1— 360 CFM I.R. Radial, 75 HP, 220/440 V.

TRANSFORMERS

3—833 KVA West. 33,000/66,000 V. to 2300 V.
4—750 KVA G.E. 11,000 V. to 440 V.
3—333 KVA West. 12,000 V. to 240/480 V.
3—200 KVA West. 2300 V. to 220/440 V.
3—150 KVA Pack. 2300 V. to 230/460 V.
3— 75 KVA All. Ch. 2300 V. to 230/460 V.
3— 75 KVA All. Ch. 4160/7200 to 2400/4160 V.
3— 50 KVA All. Ch. 2300 to 120/240 V.
1— 50 KVA All. Ch. 2300 to 120/240 V.

M.G. SETS

1—150 KW West. Syn. 900 RPM 250-2300 V.
1—100 KW G.E. Syn. 900 RPM 250-2300 V.
1— 50 KW G.E. Syn. 1200 RPM 250-2300 V.

TIPPINS MACHINERY COMPANY 1001 WASHINGTON BLVD. PITTSBURGH 6, PA.

FOR SALE

1—1000 HORSEPOWER

NORDBERG DIESEL ENGINE

Type TA-174, Four Cylinder, Air Injection, with complete auxiliaries such as pumps, coolers and starting air equipment.

ALSO

2—Murray Engine D. C. Generating Units. Sprague 250 KW D. C. Generators, 250 volt, 1000 amps, 100 R. P. M. with direct-mounted special Corliss Engine, 350 HP, size 18" and 24" x 36", cross-compound type, heavy-duty frame, complete with full equipment, oil filter, gauges and wall board.

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Immediate Possession

SPECIAL PRICE FOR QUICK SALE

Inspection Can Be Arranged By Appointment

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536 W. 22 St. Chicago 16, Ill.

IN LIQUIDATION

FOR SALE

2—255 HP, Type S Ingersoll-Rand Oil Engines, direct connected to 219 KVA, 2400 volts, 3-phase generators

1—275 HP PVG Ingersoll-Rand Gas Engine, direct connected to 237 KVA, 440 volt, 3-phase Westinghouse generator.

Units complete with switchboard panels, instruments and necessary accessories. Located: Chatham (Medina Co.), Ohio.

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Oil cooler was selected for 50% speed reduction on a constant torque loading.

Price $2,400.00 for the two (2) units.

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Primary end, 115 volt D.C., compound, 4.8 amps, secondary end 40 volt D.C., compound, 4.8 amps, 192 watts, ball-bearing, Westinghouse and Electric Specialty makes.

Price ..... $40.00 ea.

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Esterline-Angus Portable Model A W Wattmeter ac-dc, 1-2-3 phase, 0-640 volts, 5 amperes, synchronous motor chart drive, new condition.
Portable Universal current transformers, 9 ranges, 10-800 amperes primary, 5 amperes secondary, new condition.

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2—300 H.P. Watertube B. & W.
2—500 H.P. Watertube Vogt
1—150 H.P.—175# H.R.T.
54"x80'—¼" like new Steel Stack

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1721 FT. INGERSOLL RAND PRE-2—2200 V.
1302 FT. SULLIVAN WN-31—220/440 V.
676 FT. WORTHINGTON 125 H.P. 220/440 V.
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315 FT. INGERSOLL RAND 75 H.—440 V.

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15 KW GENERATOR

With International engine, 110/220 v single phase, run 30 hours, guaranteed.

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2—500 KW TURBO GENERATORS

DC, 240/120 Volts, 1200 RPM, geared to Westinghouse 500 KW Geared Turbines, 200 to 300# steam pressure, condensing, modern.

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LAnder 9311

1—125 KW 400 RPM 187½ HP Buckeye Diesel Generator Set with all accessories.

1—225 HP Buckeye Diesel 400 RPM Belted Unit.

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Phone 9074

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FREQUENCY CHANGERS
LOW-VOLTAGE GENERATORS

American ELECTRIC CORPORATION

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FOR SALE

POWER PLANT GOING OUT OF BUSINESS

1—Allis Chalmers 3200 k.w., 2300 V. generator and turbine with throttle pressure 189 lb. temp. 500° F., exhaust 28" hg.

1—G.E.—2000 k.w., 2300 V. generator and turbine with throttle pressure 189 lb. temp. 400° F., exhaust 28" hg

1—G.E.—5000 k.w., 2300 V. generator and turbine with throttle pressure 189 lb., 460° F., exhaust 28" hg.

Items above equipped with surface condensers, exciters and plant auxiliaries.

3—526 H.P. Sterling type B & W boilers with Combustion Engineering traveling grates.

ALSO Draft Fans—Pumps—Transformers • Motors—Spray Pond Equip.

Plant near Linton, Indiana. Call or Write

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1250 HP & 725 HP WESTINGHOUSE

REDUCED VOLTAGE, AUTOMATIC, 2300 VOLTS, STARTING EQUIPMENT.

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FOR SALE
DIESEL ENGINES

1—360 HP Busch Sulzer—312 KVA Generator
1—300 HP Ken Severin—with 250 KVA Generator
1—480 HP Fairbanks with 400 KVA Generato
3—360 HP Fairbanks with 300 KVA Generator
3—240 HP Fairbanks with 200 KVA Generator
1—180 HP Fairbanks with 150 KVA Generator
3—120 HP Fairbanks with 90 KVA Generator
1—240 KVA Ames Unaflo Steam Generating unit

All of the above at Bargain Prices

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60,000# Steam/hr
275# 520° TT
2 drum, Water Walls, New 1936
STEPHEN A. DOUGLASS CO.
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Nordberg-G.E. 875 KW diesel generator set, complete, 257 rpm, 2300 v., 1250 HP, w/crane.
1000 KW G.M. diesel generator sets (2), portable.
Superior diesel electric generator sets (5), 100 KW direct current, 120/240 volts.
Locomotive cranes, 40-ton diesel, 20-35 ton steam.
Locomotives, 7 to 80 tons, diesel, gas, steam.
Whirley portal gantry cranes, elec., 40-ton.
Allis-C 625 KW turbo-generator set, cond., 440 v.
H. Y. SMITH CO.
828 N. Broadway Milwaukee 2, Wis.

FOR SALE

AC TO AC GENERATOR SET

G.E., 25 KW, 440 Volt, 1800 RPM, 3 phase, 60 cycle, Type ATI directed connected to 40 HP, 440 Volt, 1800 RPM, 3 phase, 60 cycle, Type TS, Synchronous Motor for ELECTRONIC USE.

AC GENERATORS

2—7½ KW, 1800 RPM, 120/208Y, 3 phase, 60 cycle, G.E. Type AB, Model 5AB254A21 with direct connected excitors.

FREQUENCY CHANGER

General Electric, 40 KW, 1800 RPM, 3 phase, 120 cycle, 440 Volt, Driving Motor 220/440 Volt, 60 cycle.

DC GEAR MOTORS

2—20 HP, 29 RPM, Type SHB30, 230 Volt, DC, Parallel, Star Electric.

THRUSTER BRAKES

2—General Electric CR9504-N-200, 3 phase, 220/440 Volt, 3" Stroke, 200 lb. (Unused) Less Motors.

TRANSFORMERS

3—75 KVA, General Electric, single phase, 60 cycle, Pri. Volts 4160, Sec. Volts. 120/208Y, Type H, Oil Immersed Distribution Transformers, Pyranol, Serial #'s 6583313, 6583314, 6583367.

FLUSHING ELECTRIC CORP.
45-07 162nd St., Flushing 58, N. Y.
FL. 8-8700

BOSWICK ELECTRIC CO.
MOTORS
REBUILT D.C. 230 VOLTS

HP	RPM	Mfg.	Brgs.
100	450/1350	Whse.	Sl.
50	200/800	E-D	Ball
50	300/900	G.E.	Sl.
50	400/1200	Rel.	Sl.
35	400/1200	Ideal	Sl.
30	250/1000	Whse.	S. Sl.
30	350/1050	Whse.	Sl.
30	500/1500	Rel.	Ball
30	600	Whse.	Sl.
25	300/1200	Rel.	Ball
25	500/1500	C-W	Ball
25	600/1350	Rel.	Ball
20	250/1000	West.	Sl.

150 Motors 5 to 150 HP.

BARGAINS
SLIP RING

HP	RPM	Volts	Mfg.
400	300	2300	G.E.
350	450	2300	Whse.
100	1160	440	G.E.
100	1800	440	G.E.

SYNCHRONOUS

HP	RPM	Volts	Mfg.	Type
1400	1200	450	West.	100%
720	900	2300	West.	100%
200	200	440	G.E.	80%
200	1800	440	West.	100%
150	600	440	G.E.	100%
150	720	2200	G.E.	80%
150	900	220	G.E.	100%

AIR CIRCUIT BREAKERS

10—1200 ampere, 3P 2T, 600 volt I-T-E air circuit breakers.

M. G. SETS

KW	D.C. Volts	A.C. Volts	Mfg.
500	125/250	2300	Whse.
400	125/250	2300	Whse.
300	250	2300	G.E.
200	250	550	Whse.
150	250	440	Whse.
100	275	2300	Whse.
40	250	220/440	G.E.
30	125/250	2300/4000	G.E.
9	125	220/440	Burke
7½VS	250	220/440	Rel.
3VS	250	220/440	Rel.

A.C. CONTROLS

1—500 HP, 4600-3-60, G.E. CR-1034, man. red volt. starter.
1—150 HP, 2200-3-60 Roller Smith mag. red. volt. starter, auto-transformer type.
1—150 HP, Allen Bradley 220-3-60 magnetic, reduced voltage starter.
1—100 HP, 440-3-60 G.E. CR-7022Y1 wound rotor controller.
2—Size 5 G.E. magnetic starters, 220 or 440 v., NEMA 1 encl.

D.C. CONTROLS
230 volts

2—200 HP G.E. magnetic reversing, dynamic braking starters.
1—125 HP Clark magnetic adjustable speed starter.
1—New 100 HP Monitor magnetic, adj. speed starter.
1—Westinghouse 75 HP, reversing, dynamic braking starter.
3—75 HP Cutler-Hammer plain magnetic starter, NEMA 4 encl.
1—50 HP Ward Leonard mag. adj. speed starter, dyn. braking.
1—New G.E. 30 HP variable voltage controller CR 3270Y1, reversing, dynamic braking.
1—30 HP G.E. Planer Control CR 4630Y1, reversing dyn. braking.
(We can assemble any type D.C. control to your specifications)

BOSWICK ELECTRIC CO.
P.O. BOX 55 AKRON 9, OHIO
Telephone—WAlbridge 8-1195

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MAKING WASTE HEAT *"Pay off"*

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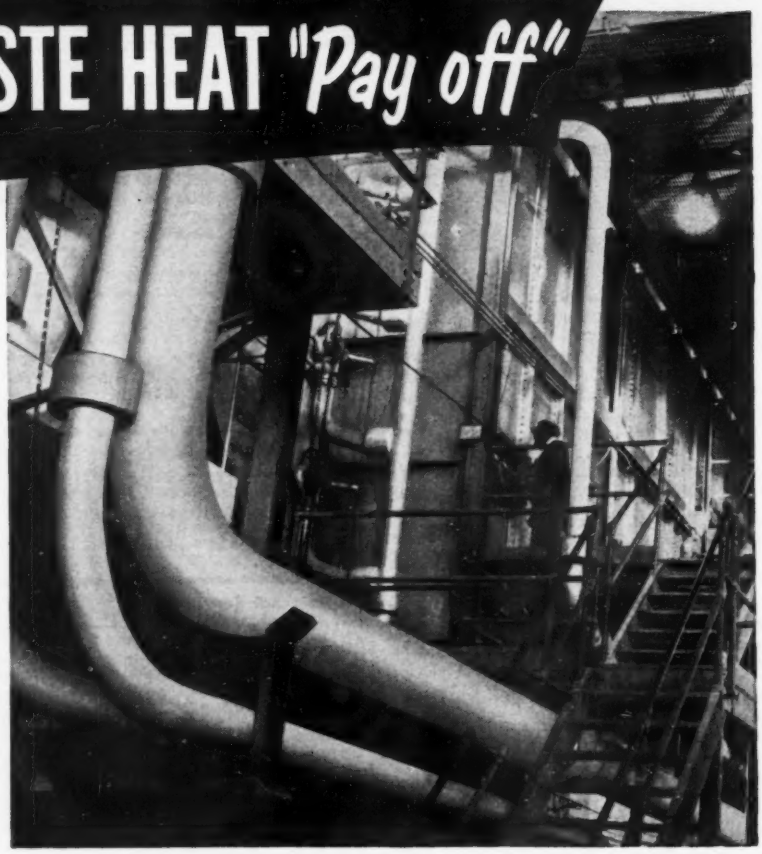

One of the East's large cement companies gets all the electric power it needs for plant operation by utilizing the waste heat from its cement kilns. This heat is first directed to a boiler which produces a continuous supply of 700°F. steam. This, in turn, is piped to a power-generating turbine—and that's where K&M insulations come in!

So that heat loss is held to a minimum, two effective K&M insulations have been used in combination on the main steam header: a 1½" layer of "Featherweight" 85% Magnesia over a 1½" layer of Hy-Temp insulation. For two smaller boiler-feed water lines, a 1½" layer of "Featherweight" 85% Magnesia is sufficient. All pipes have been finished with a canvas jacket and painted.

K&M "Featherweight" 85% Magnesia is a versatile, dependable, economical insulation for applications up to 600°F. Combined with Hy-Temp, it is efficient on installations having temperatures up to 1900°F. Both materials are supplied in a wide variety of forms and thicknesses.

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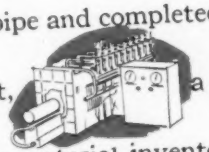
because . . . both quality and economy are guaranteed. Piping is fabricated in Grinnell shops under ideal conditions, with modern equipment, by personnel qualified in all classes of work. Price (determined in advance) includes competent engineering, scheduling and shop sketches, efficient material procurement. Grinnell supplies heat, light, power, water, compressed air, expendable tools and supplies. Grinnell shops have large storage areas for pipe and completed assemblies, expensive modern equipment,  a permanent staff of skilled workers. Grinnell finances material inventories and payrolls; carries insurance.

The customer pays for no waste material or spoilage. Shop fabricated piping is rigidly inspected and tested to meet exacting requirements of customer's specifications and applicable codes. It is cleaned inside and outside and painted. Squared to standard dimensional tolerances, sub-assemblies are erected at the job site more quickly and easily. It all adds up to this . . . shop fabrication by Grinnell guarantees quality and economy.

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Sound Selling vs. Smart Talk

Today, essentially, all of the chemical companies have established technical service and sales-supporting technical work. One corporation has 25 laboratories devoted to this type of work supported by 29 field laboratories. The total investment by the industry in such facilities, must run well into the tens of millions of dollars, which is one measure of how importantly the industry regards the sales function.

It is now estimated that 70% of the average chemical company's sales staff is technically trained compared with probably less than 25% only 20 years ago and an insignificant percentage 30 years ago. This current mode of selling is epitomized in the slogan of one chemical manufacturer, namely, "Serving Industry through Practical Applied Science."

From an article: "Selling . . . Its Importance in the Chemical Industry," by J. Warren Kinsman, Vice-President, E. I. du Pont de Nemours & Co., Wilmington, Del., in Chemical Engineering Progress.

Nalco appreciates the use of its slogan, "Serving Industry through Practical Applied Science", as an example of the modern approach to chemical sales. 100% of Nalco's field service representatives are technically trained to help industry make full practical use of the chemicals and methods developed by the Nalco Laboratories: Water, Microbiological, Physical Chemistry, Organic Chemistry, Corrosion, Micrography, Metallographic, Experimental Boiler, Combustion, Oil Treatment, Paper, Ion Exchange, Weed Control, Production Control.

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